AVIATION

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Chasing the Clouds (Vought VE7)

VOLUME XIII

Number 16

SPECIAL FEATURES

THE CURTISS MARINE TROPHY RACE

NEW WORLD'S SPEED AND ENDURANCE RECORDS

DESCRIPTIONS OF LATEST AMERICAN ENGINES

THE GARDNER, MOFFAT CO., INC.
HIGHLAND, N. Y.
225 FOURTH AVENUE, NEW YORK

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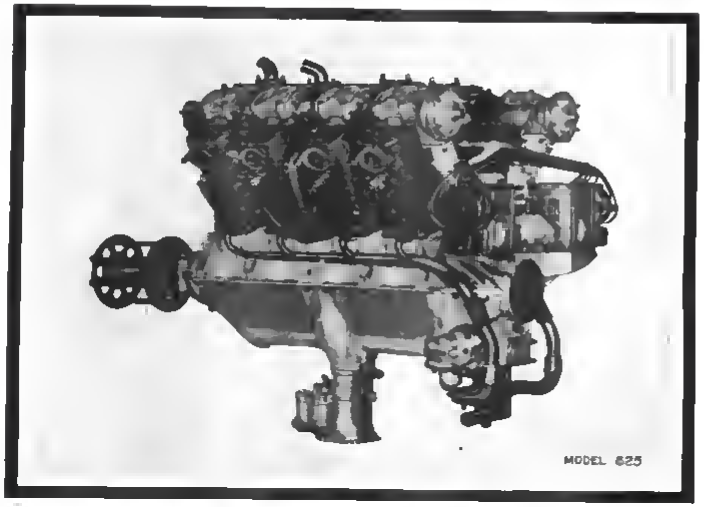

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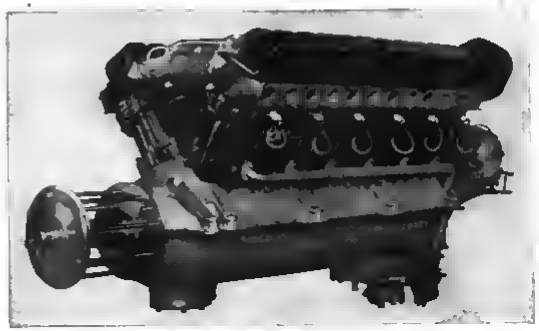

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THE CURTISS AEROPLANE AND MOTOR CORPORATION
GARDEN CITY, NEW YORK

Member Manufacturers Aircraft Association

OCTOBER 16, 1922

AVIATION

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CONTENTS

THE GARDNER, MOFFAT COMPANY, Inc., *Publishers*

HIGHLAND, N. Y.

225 FOURTH AVENUE, NEW YORK

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The Air Mail Service

WITH a view to avoiding the tedious journey, and reducing the loss of time attendant upon railroad travel, the Editor of AVIATION requested Col. Paul Henderson, Second Assistant Postmaster General, in charge of Air Mail Service, to let him travel as a passenger on one of the mail planes which were sent out from New York to participate in the National Airplane Races at Detroit. The request was most courteously granted and as a result the Editor of AVIATION was able to have breakfast in New York, luncheon in Cleveland, and dinner in Detroit—having covered the six hundred miles' distance in eight hours, as against fifteen for the fastest train.

AVIATION is too much indoctrinated in the time saving feature of air travel to consider such a trip as anything out of the ordinary. However, there are a few remarks we wish to make in this connection, based on personal contact with the Air Mail Service. The trip has afforded us the most convincing demonstration of the high degree of efficiency of that service, and incidentally an explanation of its remarkable safety record. Both the flying and the ground organization of the Air Mail are responsible for this happy state of affairs. The mail ships are kept in first class conditions both mechanically and in the matter of outward appearance. Of course, in the winter the dope and varnish may work off in sleet and snow and rain, but present appearance of the ships sufficiently displays the spirit which animates the ground force of the Air Mail. And this is not a superfluous indication; it is in such details that the *esprit de corps* of a force reveals itself. During the entire trip the Liberty engines which powered the two ships used—one remained at Cleveland for service reasons—did not miss a single stroke, and other mail ships encountered en route gave the same impression.

As to the Air Mail pilots, little can be said that may enhance their magnificent record. One has to have flown over the New York-Cleveland section of the transcontinental mail route, comprising the heavily wooded and hilly region of the Alleghanies, where emergency landing fields are notable by their absence, to appreciate the difficulties under which the men labor who fly the mail during the winter. Then the ceiling is often below the mountain tops so that the pilots have to fight their way through the valleys, bucking treacherous gusts and air currents—and yet the Air Mail comes through.

Truly, the pilots, mechanics and superintendents to whose whole hearted team work the country owes this peerless civil air service may justly be proud of their work, of which the American public knows so little.

Records at Detroit

THAT America will take the lead in the shorter distance speed records is assured by the preliminary tests of some of the government racers. Some of them have made the fastest speed ever recorded in the history of aviation for the kilometer course, and it is safe to predict that, barring accident, many world speed records will be superceded.

Records in themselves do not indicate the important significance to the government of having available the fastest pursuit ships in the world. In time of war, this asset would be of incalculable value. But there is a still more important result of this competition and that is the test of our designers and constructors to produce what in the last analysis are war machines that could out-speed any ships of the enemy. Such an achievement is worth all the expenditure that has been made for these contests.

The Aero Club Rule Book

THE Contest Committee of the Aero Club of America has just issued a Rule Book containing beside the statutes and regulations of the International Aeronautic Federation, translated from the French original, a complete set of rules governing the holding of aeronautic contests.

The aeronautical sport in America has been in sore need of just such a book, and the Contest Committee of the Ae. C. A. is to be warmly commended for having issued it. The unregulated nature of American aviation, in it in the matter of public air transport or aeronautical sport, has so far been a serious impediment upon the healthy growth of either.

The indifference of Congress in matters aeronautical explains, without justifying, the present anomalous situation of some thousand civil aircraft being operated in this country without any kind of official supervision as to their fitness, or as to the competency of their operators. The aeronautical sport has likewise suffered from the lack of effective control by its governing body, the Aero Club of America. In theory this control was exercised by the club through delegation from the F.A.I., and in accordance with the rules of the latter, but in practice few were those conversant with the F.A.I. Rules, and this for the excellent reason that they were written in French and no English translation was available.

The translation of the F.A.I. Rules would alone have justified the issuance of the Aero Club Rule Book, but the Contest Committee fortunately did not stop there in its attempt to give the aeronautical sport effective regulation. The new Rule Book contains in addition detailed instructions regarding the holding of aeronautical events, the recording of performances, the types of contests and races authorized, the duties of officials, together with some very valuable reference and conversion tables covering such calculations as constantly occur in aviation.

Altogether this book may be considered a model of its kind, and one which no person seriously concerned with the aeronautical sport can afford to be without.

The Curtiss Marine Flying Trophy Race

Flown in Boisterous Weather the Race Was Won by Lieut. A. W. Gorton, U.S.N., on a Navy TR1 Plane

By Ladislas d'Orcy

The Curtiss Marine Flying Trophy Race held at Detroit, Mich., which was postponed on account of unfavorable weather from Saturday, Oct. 7 to Sunday, Oct. 8, was won by Lieut A. W. Gorton, U.S.N., on a Navy TR1 plane equipped with 220 hp. Lawrance Model J1 engine (A.C. spark plugs, Splitdorf ignition, Stromberg carburetor) at an average speed of 112.65 m.p.h. The only other contestant who finished out of the eight who started was Lieut. H. A. Elliott, U.S.N., piloting a Vought VE7H plane equipped with a Wright E3 220 hp. engine (B.G. spark plugs, Splitdorf ignition, Stromberg carburetor), who made an average speed of 109 m.p.h.

TR1 Navy-Curtiss Seaplane, with Lawrance J1 engine, in which Lieut. A. W. Gorton won the Curtiss Marine Trophy Race

Such is in telegraphic briefness the resume of this race, which was full of dramatic incidents and tense moments that kept the 200,000 Detroiters who lined the shores of the Detroit River on the tip toe of excitement.

Some Preliminaries

It may be said quite properly that the people of Detroit have accorded this aeronautic event a reception so big in volume and enthusiasm that it probably stands without parallel in the annals of aviation.

The weather on the day of the race was as raw and unfriendly as possible. Saturday the day originally scheduled for the contest it rained continuously.

On Sunday the weather was more promising, the visibility being better, although the sky was full of low hanging clouds and a nasty wind was blowing. At noon the writer flew over the course of the race in the Aeromarine passenger flying boat Niagara, and while the air was a bit bumpy, there was no gustiness to speak of. At 2 p.m., however, when the race was started the weather took a raw autumnal aspect, with a gusty wind whipping up the surface of the Detroit river. The various squads of judges, timers and scorers prepared themselves for a cold session—and such it was indeed, particularly far those who were stationed on the marking barges in the river.

The course of the race comprised a closed circuit of 20 miles which the contestants had to cover eight times, making a total of 160 miles. The start and finish were located in front of Memorial Park, facing Belle Isle, and the course led along Belle Isle south of Peach Isle to a barge moored off the Canadian shore, then straight across the mouth of the Detroit River to Grosse Point Waterworks, thence back around Windmill Point to the start. The rules of the race provided that in completing the fifth, sixth and seventh laps the contestants taxi on the water a distance of 1260 ft. on a course laid out with a hairpin turn around the starting barge, take off again, and finish the eighth lap in flight. The first four laps were to be covered entirely in flight. This provision had been made with the evident intent to test the seaworthiness of the entries—or rather their response to control when running on the water.

Outside of this provision the Curtiss Marine Flying Trophy Race was a speed event pure and simple, but the inclusion of the "navigability tests," which had never before been attempted, greatly increased the interest in the race. Indeed, it is a different matter to have a navigability test—as it is done in the Schneider Cup races—take place independently of the race proper, so that the contestants can take all the time to show their water control by taxiing in a careful manner, and to include such a test in the course of a race. It is obvious that a pilot fired by the spirit of competition will take risks in taxiing at high speed such as he would not take in a navigability test. This is precisely what happened in the race.

The Start

Of the ten entries published in our issue of Oct. 2, eight started—the two missing entries being the new Vought UO1 which Capt. F. P. Mulcahy, U.S.M.C., was to pilot and which was insufficiently tuned up for the race, the other absentee being the Curtiss HA2. The other entries started in the following order at one minute intervals—more or less—depending on the degree of readiness of the entrants.

No. 5—Lieut. R. Irvine, Curtiss 18T (375 hp. Curtiss D12)
No. 16—Lieut. D. Rittenhouse, Navy TR3 (220 hp. Wright E3)
No. 12—Lieut. S. W. Callaway, Navy TS1 (220 hp. Lawrance J1)
No. 15—Lieut. A. W. Gorton, Navy TR1 (220 hp. Lawrance J1)
No. 3—Lieut. W. K. Patterson, Gallaudet D4 (420 hp. Liberty)
No. 4—Lieut. L. H. Sanderson, Curtiss 18T (375 hp. Curtiss D12)
No. 10—Lieut. H. A. Elbett, Vought VE7H (220 hp. Wright E2)
No. 11—Lieut. H. J. Brow, Navy TS2 (240 hp. Aeromarine U8D)

The manner in which the start was given, from a special barge moored in the river, and with a Navy-like display of bunting and signal flags is explained in detail in the rules of the race, printed in the Oct. 2 issue. The provisions for raising and lowering vari-colored flags sound to most people complicated, but he it said to the credit of the Contest Committee of the Aero Club of America, under whose regulations the Detroit Aviation Society ran the Curtiss Trophy race, that these provisions worked perfectly. There was not a hitch in the organization program, each machine taking off as signalled, and so the large number of men wearing impressive arm bands of all hues who dotted the land-scape really justified their presence—and their armbands. Their number would be difficult to evaluate, suffice it to say that they were under Referee Caleb Bragg and that the judges comprised the following: H. W. Alden, chairman of the judges' committee; H. M. Jewett, Martin Pelcher, Ladislas d'Orcy, Russell Huff, Rev. Long, C. L. Wood, J. Gordon Rankin, L. R. Buckendale, R. L. Messmer, A. L. Swank, T. P. Myers, Don T. Hastings, R. Stahl, John Dwyer, G. B. Allen, W. B. Morgan, Walter Geibert, C. H. Brennan, Lieut. Comdr. Spencer, U.S.N., Lieut. Botts, U.S.N., Lieut. Congdon, U.S.N.

The end of the first lap showed little difference in the relative place of the contestants. No. 16 (Lieut. Rittenhouse) who had started second, came in first, closely followed by No. 5 (Lieut. Irvine), but the remainder followed in the order of the start. At the end of the second lap No. 16 was still leading, with No. 5 second, but No. 12 (Lieut. Calloway) had dropped from third to fourth place, while No. 15 (Lieut. Gorton) had worked up to third and No. 4 (Lieut. Sanderson) edged up to fifth place. From then on Lieut. Sanderson, with his Curtiss 18T, visibly jumped into the limelight and his return was expected with heightening interest. In the following lap (the third) he had attained fourth place, and in the fourth lap third place, when only No. 5 (Lieut. Irvine, who also flew a Curtiss 18T) and No. 15 (Lieut. Gorton) were ahead of him. It was now that things began to happen. No. 16 (Lieut. Rittenhouse), who had lead until the close of the third lap, dropped out during the fourth lap in a sudden manner. We saw him from the starting barge, as he suddenly sideslipped near what we called the "gas house", but what in reality was the Edison plant, and went out of sight. Later we learned that his propeller had worked loose and that the resultant vibration made him make a quick landing in which he landed on one wing, deleting the better part of it. The pilot was fortunately not hurt. In the same lap, No. 11 (Lieut. Brow) had to quit the race when he found himself minus all his radiator water, which had apparently trickled out through a leaky joint.

Not on the Program

But the real thrills of the race came in the fifth lap, when upon completing it the entrants had to dive for the surface of the water and taxi around the starting barge in a hairpin turn and then get up speed again and take off. First came No. 5 (Lieut. Irvine). He dove at fairly high speed—in a cross wind, by the way, which made the maneuver particularly delicate and rather thrilling for the occupants of the barge in the direction of which the wind was blowing—and bounced off several times until he could kill his speed and taxi around the barge. His was far above taxiing speed and as the machine was nearly at flying speed it proved hard to handle her in the air as well as on the water, so that at one time it looked as if No. 5 would ram the barge. But Lieut. Irvine finally managed to turn around the barge and he was off again quickly. No. 15 (Lieut. Gorton) rounded the barge at less speed, but No. 4 (Lieut. Sanderson) nearly repeated the performance of No. 5. By that time the occupants of the barge began taking a very personal interest in the navigability tests. At the end of the fifth lap the remaining contestants were in the same relative order as they had been in lap four, as follows: Nos. 5, 15, 4, 12, 3, and 10.

Soon more thrills were to come. No. 3 (Lieut. Patterson) had just "sat down" for taxiing but was having difficulties with the cross wind, and slowed down, and eventually came to a stop right between the two barges which marked the channel land ont for the navigability test. At the time we thought his engine had "conked" out, although later it was found that his propeller had been damaged, probably in a taxiing test. But we had little time for musings, for No. 4 had no sooner come to a stop than two planes were reported coming down for the taxiing test. They were No. 15 (Lieut. Gorton), flying rather high, and No. 4 (Lieut. Sanderson), who was flying at a much lower level and who was closing in on No. 15, determined to beat him to the barge. In the meantime a police boat had gone to the disabled No. 3 and another motor boat sped off in the same direction to tow her off the course. It was the only sensible thing to do, but the time in which to accomplish it looked hopelessly inadequate, while the course was, as a result, badly crammed. Either on purpose, to avoid hitting the disabled No. 3, or through misjudgment, No. 15 widely overshot the line where it was supposed to begin taxiing, which enabled No. 4 to dive to the surface close to the barge, but she made a rough going of it porpoising. On seeing that she had failed properly to round the mark, No. 4 slowed down to real taxiing speed and made a complete circle around the barge, after which she was off again. No. 15 also made a complete circle of the barge and so the rules of the race were respected. It was an exciting moment and only the remarkable level headedness of both

Curtiss Marine Flying Trophy

Lieutenant Gorton and Lieutenant Sanderson averted the threatened collision

These incidents, marking the completion of the sixth lap, were not the only ones to happen at this time, for when No 10 (Lieut Elliott), who had been in sixth place the preceding lap, presently came around in third order, and Nos. 5 and 12 did not show up, it was generally feared that these entries had abandoned for some reason or other These fears were justified We soon learned that No. 5 (Lieut. Irvine) had performed a very spectacular and dangerous crash near the Edison station and that the pilot was unhurt, while No 12 had abandoned on account of engine trouble. What first happened to No 5 was that, probably on a taxiing test, one of the wing pontoons had been twisted out of place so that the machine became difficult to handle When Lieut. Irvine then came in over the power house the gustiness caused by six giant smokestacks throwing the ship out of control The pilot attempted to land in a small cove, but realizing that he would overshoot it, he deliberately headed for a coal pile and attempted a landing The ship crumpled up and was reduced to kindling wood, but the pilot, having served by a miraculous luck, rolled out of the machine for some 40 ft. and got up with a smile and unhurt One of the pilots who saw this rough landing from the air declared it to have been the most unusual sight he had ever witnessed and there was general rejoicing when it was known how Lieut Irvine had escaped any injury

As to No 12, it appears that some minor part, not determined yet, went wrong in the engine and made its operation irregular, whereupon the pilot, with excellent judgment throttled down and returned to the Navy base at a reduced speed.

The Finish

This left three contestants in the race—No 4 (Lieut Sanderson), who was now general favorite as the probable winner, No. 15 (Lieut Gorton) and No 10 (Lieut Elliott)—the order in which the three ships rounded the water control at the end of the seventh lap Lieutenant Sanderson had flown a magnificent race, working up his way lap by lap, and his victory seemed so certain and generally hoped for that when No 15 was the first to finish the eighth and last lap, (in flight, as the rules provided) and was eventually followed by No. 10, the dismay at Lieutenant Sanderson's disappearance was well nigh general Lieutenant Sanderson had really hard luck, for he ran out of gasoline in the middle of the eighth lap and was forced to come down and abandon the race after he was in sight of the finishing line

The sympathy expressed for Lieutenant Sanderson does not in the least detract anything from the splendid performance furnished by Lieutenant Gorton on the Navy TR1 plane, equipped with the 220 hp Lawrance Model J1 engine, and built to the designs of Comdr J. C Hunsaker (C C) U S N, Chief of the Design Division of the Bureau of Naval Aeronautics. For if Lieutenant Sanderson worked up from sixth to first place in seven laps, while Lieutenant Gorton slid into first place from fourth in six laps, it should be remembered that Lieutenant Sanderson's 18T plane, having a 400 hp engine, was despite its greater weight a much faster craft then the TR1 of Lieutenant Gorton, which only had a 220 hp. engine.

Following are the principal performances made in this race. Lieutenant Gorton, the winner, averaged for eight laps 112.65 m.p.h., but as in this time there is included the slowing down necessary for the navigability tests, a better idea is had of the actual circuit speed of the Navy TR1 by considering only the average time of the first three laps, which works out as 117 6 m.p.h. The Vought VE7H piloted by Lieutenant Elliott, which finished second made an average speed for eight laps of 109 m.p.h. and a speed of 112 m.p.h. for the first three laps. The best time was, however, made by Lieutenant Sanderson's Curtiss 18T, which averaged 124.6 m.p.h. for three laps, and which covered the fourth lap at a speed of 125 5 m.p.h. The latter was the best time made by any contestant in the race.

Those who looked to an event like the Curtiss Marine Flying Trophy race to bring forth new world's seaplane records may perhaps be disappointed at the results of the Detroit Aerial Water Derby However, it is only proper to point out to them that this contest was not one designed primarily for speed quite on the contrary, the ships entered had to satisfy certain conditions of water control which are of considerable importance in seaplane design and operation. Speed was a secondary consideration, although the event had naturally to be competed on the basis of speed, since that is the criterion of almost any mechanical contest, and particularly so in aviation.

From the technical viewpoint, interest in the race chiefly centered in the recent products of the Bureau of Aeronautics of the Navy Department, the TS and TR planes. These ships all belong to a same general type which was developed for purely naval requirements, and mainly differ in their power plant, wing section and pontoons.

Navy TS and TR Types

Types TS1 and 2, and TR1 and 3 are variations of the Navy shipboard combat plane type TS designed under Comdr J C Hunsaker by the Design Section of the Bureau of Aeronautics and built at the Naval Aircraft Factory The TS planes were designed to give the smallest and most compact plane with the maximum facilities for take-down and erection aboard ship All wires and turnbuckles in the wing bracing are eliminated to facilitate rapid erection. The fuel tank is carried in the lower wing and is made detachable so that in case of fire, due to an incendiary bullet, the pilot can pull a release which will drop the tank and its inflammable contents clear of the machine. Another unique feature is the provision of interchangeable landing gears so that the TS planes may be used with land wheels as an ordinary land plane, or with twin pontoons as a seaplane depending upon the service required.

The TR1 is the same TS plane provided with a Lawrance air-cooled engine, but given special racing wings.

CHARACTERISTICS
Type, tractor float biplane
Span upper and lower, 28 ft. 0 in
Length 24 ft 7 in
Height 9 ft. 6¾ in
Chord 4 ft. 6 in
Gap 6 ft 6 in
Angle of incidence, 0
Dihedral 3 deg (lower wing only)
Wing area 225 sq ft.
Aerofoil section USA27
Gross weight, TS1 2,020 lb TS2 2 080 lb
Maximum speed TS1 126 m p.h. TS2 120 m.p.h.
Engine, TS1 Lawrance J1 220 hp TS2 Aeromarine U8D, 240 hp.

CHARACTERISTICS
Type, tractor float biplane
Span upper and lower, 25 ft. 0 in
Length, 24 ft. 7 in
Height, 9 ft. 6¾ in
Chord 4 ft. 6 in.
Gap 6 ft. 6 in
Angle of incidence 0
Dihedral 3 deg (lower wing only)
Wing area 225 sq ft.
Aerofoil section, Mod. RAF19
Gross weight, TR1 1 793 lb. TR3 1,980 lb
Maximum speed 120 m p.h.
Engine, TR1 Lawrance J1, 220 hp. TR3 Wright E3, 220 hp.

TIME PER LAP OF THE CONTESTANTS IN THE CURTISS TROPHY RACE

No	Plane & Engine	LAPS 1st	2nd	3rd	4th	5th	6th	7th	8th
12	Navy TS1 (220 hp Lawrance J1)	11-00.35	11-40.40	11-41 24	11-44 15	11-43 96			
16	Navy TR3 (220 hp Wright E3)	10-28 0	10-16.93	10-21.75					
5	Curtiss 18T (400 hp Curtiss D12)	14-08 73	10-31 88	10-34 49	10-24 78	10-36.32			
4	Curtiss 18T (400 hp Curtiss D12)	9 52 95	9 46 81	9-35 39	9 34 18	9-51 09	10-19 0	10-15-7	
10	Vought VE7H (220 hp Wright E3)	10-56 19	10-47 13	10-40 04	10-47-35	10-57 42	11-22.27	11-28 15	11-19 83
3	Gallaudet D4 (420 hp Liberty)	11-41 42	11-24 20	11-25 85	11-35 97	11-36 73			
15	Navy TR1 (220 hp. Lawrance)	10-07 89	10-08 66	10-07 94	10 17 51	10-42.10	10-58 50	11-17.90	11-32.67
11	Navy TS2 (240 hp Aeromarine U8D)	11-17.54	11-48 28	11-47 32					

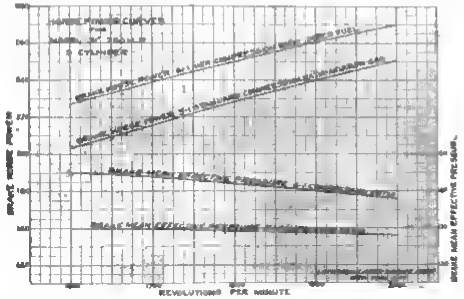
Courtesy Army and Navel Journal

Lawrance Model J1 Aircooled Engine

Details of Power Plant Used in TR1 Seaplane which Won Curtiss Marine Trophy

The Lawrance Model J1, 9 cyl. aircooled radial engine is the power plant used in the TRI seaplane which, piloted by Lieut. A W Gorton of the Navy, won the Curtiss Marine Trophy Race at Detroit, Oct 8, with an average speed for the 160 mile course of 112.65 m.p.h In the average is included time in the air and time necessary to alight, taxi around the judges barge in a hairpin turn and take off again on the fifth, sixth and seventh laps, as provided by the rules of the race

Charles T. Lawrance, president and chief engineer of the Lawrance Aero Engine Corp., of New York, is the designer of the J1 which is now being produced on orders from the Army and Navy The engine was originally designed for the Navy as a 200 hp engine especially for the problem of ship-



Power Curve Chart, Lawrance J1 Engine

board combat airplanes where minimum weight and greatest simplicity are prerequisites It has since been developed to a 276 hp. engine at 1970 r p m's.

The engine installed in the TRI Navy seaplane which won the Curtiss Marine Trophy Race is a standard production job It has proven also especially adapted for Army advance training and is being used for that purpose in the Huff-Daland Model HD9A plane

SPECIFICATIONS

No. of cylinders, 9
Type of motor, radial
Cooling, air-cooled
Bore, 4½ in
Stroke, 5½ in
Swept volume, 874.5 cu in
Compression, 5-1
Rated hp. 200 at 1700
Fuel consumption 0.5 lb per hp hr
Oil consumption 0.03 lb per hp hr
Inlet valves 1 per cylinder, 2 in dia. in clear
Exhaust valves, 1 per cylinder mercury cooled, 2 in dia. in clear
Valve lift 7/16 in

Cylinders

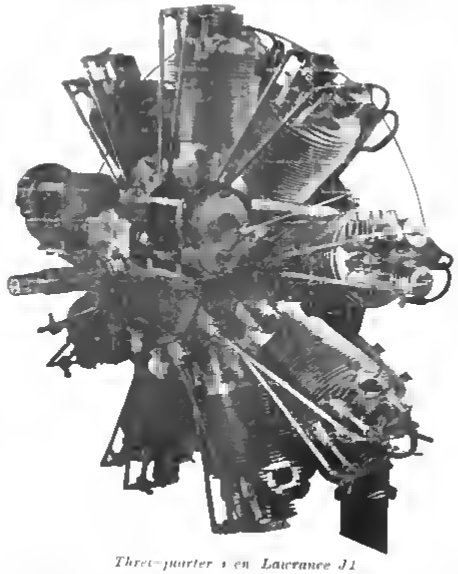
The cylinder is an aluminum casting integral with the head, valve ports and cooling fins, with a case hardened steel liner 1/16 in thick shrunk into place

The valves are placed at an angle of 8 deg with the center line and rest on bronze seats cast in the cylinder The valve guides are of bronze Double springs are employed for each valve which are operated by rockers and push rods extending from the cam disc which is located in the front portion of the crankcase Each cylinder is held in place on the crankcase by eight 3/8 in studs Two spark plugs are provided for each cylinder.

Crankcase

The aluminum crankcase consists of three portions. The front cover contains the magneto drive gearing, the deep groove Hess Bright radial type thrust bearing, and has two magnetos supporting brackets located on each side of the crankshaft This location of the magnetos insures their accessability with the removal of the minimum amount of cowling, thus guaranteeing their proper inspection and maintenance

Between the front cover and the main body of the crankcase is located the intermediate cover containing the cam driving gears and counter shaft, the cam disc, the cam followers and their guides and having a solid web at its rear



Three-quarter view Lawrance J1

portion, supporting an S K.F self aligning ball bearing which forms the front main bearing of the crankshaft.

The construction of the front and intermediate covers allows the inspection of all the cam operating mechanism in place with all gears meshed, by merely removing the front cover, thus avoiding the need of any "blind" operations in assembly

The main portion of the crankcase consists of a circular drum, with nine openings through which project the nine cylinder liners, an opening for the oil sump between cylinders five and six and a rear wall in which is located an S K F self aligning ball bearing which forms the rear crankshaft bearing.

At the rear of this wall is a conical extension of the same approximate diameter of the main portion of the case, which is used for mounting the engine to the front bulkhead of the fuselage

Crankshaft and Reciprocating Parts

The crankshaft is a one piece forging of chrome nickel steel, heat treated It is hollow for oil circulation, and is

provided with 29 small integral splines near its forward end for mounting the propeller hub The 30th spline is left blank to insure always putting the hub on in the same position.

On the crank cheeks are assembled two bronze balance weights which completely neutralize all reciprocating and centrifugal forces and insure a remarkable absence from vibration

The shaft is mounted on three ball bearings mentioned above and plain bearings at the front and rear ends through which a flow of oil is introduced into the crankshaft.

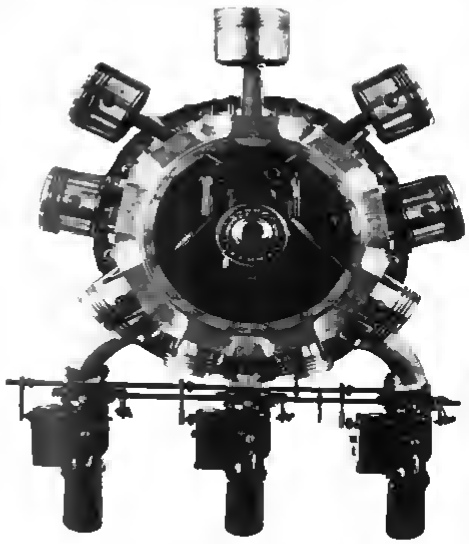
The crank pin is a plain bearing of large area on which runs the babbited big end bearing of the master connecting rod

The master connecting rod is an I section rod forged from chrome nickel steel having a big end provided with flanges at each side, which forms the supports for the knuckle pins of the eight other articulated connecting rods. The big end is split, as in the conventional type of connecting rod, and is held together by four heat treated alloy steel cap screws. By reason of the heavy flanges at each side of the big end, this bearing is exceptionally rigid, and in service shows a very long life

The articulated rods are of round hollow section of chrome nickel steel, bronze bushed at both ends The knuckle pins which attach these to the master rod are fixed in the latter by clamping plates, one for each two pins, which not only hold them in place but prevent any rotation

By means of this system, all the knuckle pins can be removed through the opening formed by removing the front end intermediate covers, by merely removing the four locking plates and withdrawing the knuckle pins with a special form of puller which is provided This can be done without removing the engine from the plane

The wrist pins float in both the pistons and connecting rods, and are held in place by small aluminum buttons, pressed into the ends of the hollow pin. The pistons are of conventional design and made of aluminum alloy with a heavy flat head, and are provided with four rings above the pin and one in the skirt. The skirt ring, and the lowest upper ring are bevelled for half their surface, the bevel being toward the top, and act as wiper rings to prevent excess oil getting into the cylinders



Connecting rods and pistons, Lawrance J1

Lubricating System

The lubricating system consists of two oil pumps one of which draws oil from the tank and delivers it to the crankshaft, and another, which draws oil from the sump and returns it to the tank.

These pumps are at the rear of the engine and are driven by spur gears from the lower end of the synchronizer drive shafts.

Incorporated in the casing of each pump is a chamber containing a strainer which can be removed separately or as a unit with the pumps. On the pressure pump is an oil by pass valve controlled by a heavy spring, which is intended as a safety valve in case of too sudden warming up of the engine in cold weather when the pressure might rise to a point where damage might occur

The oil flows from this pump through a fine mesh screen to a bearing on the rear of the crankshaft which is provided with spiral grooves at this point so as to prevent oil leakage. It flows from here into the shaft and also is led by small ducts to the top of the synchronizer drive ball bearings, the fuel pump and electric generator and tachometer drive gears.

The oil in the crankshaft travels through an ample passage to two holes located in the crank pin, where it is fed to the bearing by a pressure of approximately fifty pounds.

Through small holes in the bearings it is led to the interior of the knuckle pins and thence to the knuckle pin bearings. The oil escaping from these bearings and from the sides of the main connecting rod bearing is thrown into the cylinders and lubricates the wrist pins, pistons and cylinders.

The remainder of the oil in the shaft travels to the front end of the engine where a small quantity escapes through a special jet, which projects into the inside of the shaft to prevent its possible obstruction by sediment

This oil sprays on the interior of the cam bearing and also lubricates the cam followers and rollers and the cam drive and magneto drive mechanism.

The remainder of the oil flows to the front end of the engine where it escapes into an oil collector bearing. An adjustable oil pressure valve is located at this point maintaining any desired oil pressure in the system. The excess oil is then led back to the tank.

The oil which is thrown off from the moving parts flows by gravity into a sump from which it is drawn through a strainer to the oil return pump and thence to the tank.

Carburetors and Manifolds

The inlet system consists of three NAS4 Stromberg carburetors and three separate ring shaped manifolds, each one of which acts as an independent intake system for three cylinders at 120 deg. from each other

The carburetors are equipped with altitude control consisting of an auxiliary air inlet controlled by a throttle admitting air to a point between the Venturi and the main throttle.

The flow of air through this passage also by means of a small communicating hole sets up a slight depression in the float chamber thus diminishing the flow of fuel at the jet. The float chambers are located at the side of the jet so that steep angles of climb and descent have no effect on the level of the fuel in the jet.

The intake tubes leading from the crankcase to the cylinders are joined by rubber hose connections thus allowing for expansion and contraction and for slight errors in alignment.

Ignition

The ignition system consists of two Splitdorf SS9 magnetos having variable advance both running anti clockwise at one and one eighth engine speed.

Performance

The rated power of the engine is 200 hp at 1700 r.p.m., but actually our engine developed considerably more than this. The horsepower curve published in this article shows a horsepower of about 215 at 1700 r.p.m. which is the average performance of the engines now being produced. It will be seen that this power runs to 245 hp. at 2000 r.p.m., and that the m.e.p. nowhere falls below 128 lb. per sq. in. The fuel consumption at full throttle is less than 0.05 lb per hp hour when

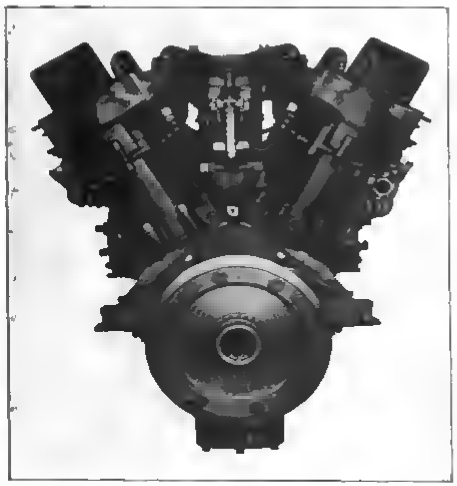
(Continued on p. 517)

Curtiss Model D12 Aeronautical Engine

New 400 Hp. Motor Presents Many Refinements of Design

By Arthur Nutt, D.S. M.S.A.E.

The Curtiss model D12 engine is a development from the Curtiss model CD12 engine of the same bore and stroke. After exhaustive tests on the model CD12 engine it was decided to entirely rebuild the engine to decrease the weight if possible, increase the reliability if possible and improve the present fine accessability. The seven-bearing crankshaft was retained as well as the well known use of main bearing caps



Propeller end view Curtiss D12

on the crankcase. The distribution of the bearing areas on the main journals was changed to conform with the Air Service requirements. This change necessitated the making of entirely new patterns and forging dies for all the main parts of the engine. A careful study was made of each individual part on the engine during this redesigning in order to save weight as well as increase the strength if possible. The details of changes in the various parts of the engine are outlined below. The result of this redesign was an engine weighing 35 lb less than model CD12 developing 10 to 15 hp. more at the same speed.

The Curtiss D12 engine of the 60 deg. Vee type consists of two rows of six cylinders en bloc having a bore of 4½ in. and a stroke of 6 in. with a total displacement of 1145 cu. in. The engine is of the aluminum cylinder type with inserted steel sleeves in contact directly with the cooling water. The engine uses two overhead camshafts per cylinder head driven through beval gearing and operating four valves per cylinder.

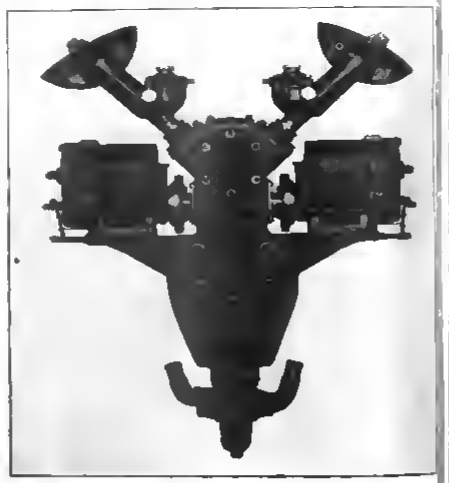
Cylinder Head Construction

The same cylinder head construction as used in the CD12 engine has been retained. Steel cylinder sleeves of carbon steel hydraulically forged with one end closed are rough machined, heat-treated and then finished machined before assembling in the cylinder head with the exception of the final grinding of the bore. The threaded portion of the sleeve is approximately 1½ in. long at the upper end. Careful machining is done on these sleeves and the cylinder head to maintain a perfect joint between the aluminum head and the steel sleeve. An integral stud on the end of the closed head of the sleeve passes through the water jacket thereby improving the contact between the steel head and the aluminum head. The valve port holes are machined after the sleeve is assembled. Spark plug bushings are also assembled after the sleeve is in place, duralumin bushings being used in place of brass as was former practice. The aluminum water jacket which is cast in one piece for six cylinders is assembled over the lower end of the six sleeves, the water joint being maintained between the sleeve and jacket by a composition gasket under the flange on the sleeve. The upper joint is made tight with a copper asbestos gasket. The sleeves fit very snugly in the water jacket at the lower end which gives them ample support to prevent the thin sleeve from going out of round.

Reduction in valve size of 0.040 in. was found necessary to make the valves removable from the cylinder without removing the valve guides. This slight decrease in valve size had no effect on the power since the power is mentally higher in this new engine than in the CD12 engine.

Valve Mechanism

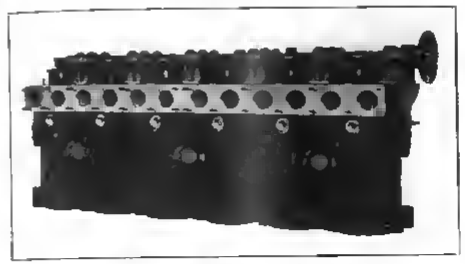
Each cylinder is fitted with four steel tulip valves, two intake and two exhaust which are interchangeable. These valves seat directly in the steel cylinder head as in former practice.



Curtiss D12 gear case assembly

The camshafts are mounted on the top of the cylinder head on six aluminum brackets, the shafts running directly in the aluminum. These brackets are carefully dowelled to the head and are interchangeable, no alignment, reaming or hand scraping being necessary during manufacture or overhaul. The intake camshaft is driven by the exhaust shaft through spur gears at the anti-propeller end. A bevel gear is mounted on the exhaust camshaft in a novel way. The spur gear on the exhaust shaft is extended beyond the width of the normal gear and the bevel gear is internally splined with a Fellows Gear shaper to fit over this extension. A single large flanged nut holds this gear on the shaft. Owing to the fact that the number of teeth on the spur gear differs from the number of teeth in the bevel gear a very fine adjustment is obtainable on the timing by shifting the gear in relation to the shaft.

One cam operates two valves through a Tee shaped tappet



Cylinder Block, Curtiss Model D12

working in a bushed hole in the cylinder head. This tappet has been redesigned to increase its strength, reduce wear and facilitate production. This type of tappet removes all side thrust from valve stems. The valves are adjusted as before by adjusting screws clamped in the ends of the Tee tappet. The camshaft bearings are lubricated by oil pressure of approximately 10 lb. per sq. in. and the Tee tappets and valve guides are oiled by splash.

Crankshafts

The crankshaft is of the conventional seven-bearing type being made of low chrome nickel steel. The crankshaft has been redesigned to take care of the redistribution of the main bearings, the center bearing being 1¾ in. effective length and the balance of the bearings 1½ in., thereby doing away with the three 1 in. bearings used in the CD12 engine making larger bearing surfaces and decreasing manufacturing costs. The same journals and crank pin sizes of 3 in. and 2½ in. respectively have been retained. The crank cheeks have been made oval instead of rectangular increasing the width ¼ in. and decreasing the weight of the crankshaft at the same time giving a stronger and lighter shaft. The same type of propeller thrust bearing is used on this engine mounted between No. 7 and 8 main bearings, namely, a deep-grooved radial annular ball bearing. This bearing takes thrust in either direction and the method of mounting adds greatly to the rigidity of the propeller in flight and gyroscopic forces are well taken care of by this arrangement.

Crankcase

The upper crankcase cast from an aluminum alloy is practically the same as on the CD12 with the exception that the nose has been shortened after removing the propeller and electric starter bosses. The cast aluminum main bearing caps have been replaced by duralumin forgings having four times the strength for the same weight. Each cap is carefully keyed to the crankcase to prevent it from shifting during operation.

Bronze backed babbett lined bearing shells are used, held in place by countersunk head brass screws. The babbett bearings are bored to size in a boring mill, thereby maintaining the clearances in all bearings the same and insuring perfect alignment.

Accessory Drive Shaft and Gearcase

On the anti-propeller end of the engine is mounted a typical gearcase as used on this type of Curtiss engines. This gear case has been redesigned to provide better accessability and to make provision for mounting of the Air Service gear gasoline pump as well as gun generator drives. The use of this type of gear case facilitates production and permits lighter weight. As used in the CD12 engine all shafts and gears are assembled using stub-tooth teeth as splines. Although the engine has a 60 deg. angle between cylinder banks, the vertical drive shaft is brought to a height where 90 deg. drive shafts run directly to the bevel gears on the exhaust camshafts. The tachometer drive has been removed from the vertical shaft which runs 1½ crankshaft speed and has been taken off of the left hand exhaust camshaft thereby simplyfying the design and making the drive more accessible. All gears have stub teeth.

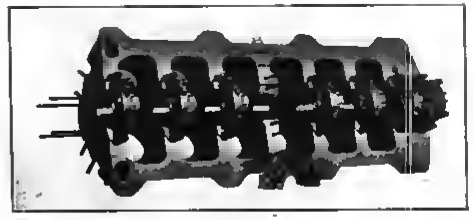
A very satisfactory magneto coupling drive has been developed for the D12 engine. This drive consists of a combination of an Oldham coupling and thermoid disc with a micrometer adjustment obtained by the use of a series of holes of different total number in two discs. The Oldham coupling takes care of all offset and the thermoid disc takes care of angular misalignment as well as protecting the magneto from gear shocks.

The water pump design has been changed to provide a ball bearing in the water pump in place of a plain bearing and a splined shaft drive in place of the squared coupling formerly used. Adequate glands have been provided to prevent both oil and water leakages. An Alemite connection is used on the water gland to keep the packing lubricated to prevent leakage. The lower vertical drive shaft is designed to drive the Curtiss triplex plunger gasoline pump and the Army Air Service gear pump. The upper end of the upper vertical shaft is indirectly splined for a Liberty generator. The gearcase is provided with a boss to take the Bijur anti-propeller end starter.

Pistons

The same type of piston is used in the CD12 engine, being the ribbed head type, which gives a light weight piston of considerable strength. The rings have been lowered to provide a wider top land and to make the rings all the same width, namely, 3/32.

The piston pins float in the pistons and connecting rods being held in place by means of piano wire snap rings. There



Upper crank case, Curtiss Model D12

has been no change in the connecting rod assembly, this being the articulated type, the short rod being forked over a boss on the master rod. Nou-gran bushings are used for the wrist pins and piston pins.

Lower Half Crankcase

The lower half crankcase has been entirely redesigned to eliminate the oil tank which was formerly built into the engine. The oil pump was also redesigned, three separate pumps being used instead of the three gear suction pumps and the two gear pressure pumps. By this means weight was saved and the drive of the pump was greatly simplified. The oil pump is driven from the lower vertical shaft in the gearcase through spur gearing, a train of three gears being used. The middle gear is adjustable to obtain the proper gear back lash without necessitating careful machining for center distance.

Carburetion

At the present time the engine is fitted with two Zenith U.S.54 carburetors which have been rebuilt to provide parallel

throttles and an improved mixture control This change with the proper carburetor setting has given an extremely flexible engine coupled with wonderful acceleration without sacrificing maximum power. The two carburetors are interconnected with a cast aluminum air duct, which obtains its air through a sheet aluminum air stack from outside of the airplane body.

Ignition

Two single spark 12 cylinder Splitdorf magnetos model SS12 are used for ignition on the engine feeding two spark plugs per cylinder placed diametrically opposite. One magneto is wired to the exhaust plugs and the other to the intake plug. The use of these magnetos has resulted in the saving of over 6 lb total weight without a sacrifice of performance or reliability.

Cooling System

The cooling system had only a few slight changes. The pump has been redesigned as stated above, the double shrouded type of impeller being retained The capacity of the pump has been increased slightly As before the pump delivers water through a distributing manifold on the lower end of each cylinder block, discharging at the top into another manifold

This engine has been designed to use water manifolds for the outlet directly on the cylinder head thereby eliminating the objectionable feature of passing water through the intake manifold gasketed joint.

Lubricating System

The conventional Curtiss lubricating system is used on this engine, being refined to such a degree that a consumption of 0 015 lb. per B H P. per hour may be used as an average figure for continuous flying Minimum figures of one half this value have been obtained in block testing The scavenging pumps, which are now entirely separate, eliminate any chance of air entering the system and thereby destroying the pump capacity. These scavenging pumps have been increased fifty per cent in capacity All plain bearings in the gearcase are pressure fed with the exception of the lower vertical shaft which runs in a bath of oil. All other bearings are splash fed by the oil running back from the camshafts which are carefully housed in with an oil tight housing

Propeller Hub

The propeller hub has been redesigned so that standard Liberty bolt size and bolt circle are used A novel use of duralumin has been made by the use of this material in the loose flange.

Gasoline System

The gasoline system used on the high speed airplanes using the D12 engine consists of the Curtiss triplex gasoline pump feeding gasoline directly to the carburetor, an overflow being provided from this pump to take care of the over capacity of the pump The gasoline is fed with a relief valve to maintain a constant pressure. This type of pump gives positive priming and unusual reliability since the pump is oiled under pressure against leakage past the pistons and the speed of 325 r.p.m is very low.

Summary

With the above changes, an engine has been obtained weighing 670 lb without water and delivering 400 B H P. at its normal speed of 2000 r.p.m. By the use of higher compression ratios and doped fuel as well as higher speeds this power is materially increased so that the result is an engine which develops a minimum of 430 hp. at 2200 r.p.m. This engine has been submitted to a Navy 50 hr. test showing very good performance and other tests are now being conducted during the production of more engines. A list of general specifications of the engine is given below.

The B H E P obtained in this compact engine are as high at 2000 and 2200 r.p.m. as obtained usually in an engine running at 1800 r.p.m The Curtiss D12 engine represents more nearly the ideal airplane engine than any other motor owing to its light weight and low head resistance per horsepower which allows the engine to operate at light power having a tremendous reserve power for emergency coupled with reliable operation at full power.

CHARACTERISTICS

Name	Curtiss
Hp	375 at 2000 r.p.m. (rated)
Model	D12
Type of motor	Water-cooled "vee"—direct drive.
Number of cylinders	12
Length of motor	66 7/16 in.
Width of motor	28¾ in
Height of motor	34¾ in
Displacement of motor	1145 cu in.
Bore	4.5 in
Stroke	6
Compression ratio	5.6 to 1
Compression in lb per sq in	—
Type of piston	Alumin. trunk ribbed
Piston displacement	85.4 cu in
Number of piston rings	3 per cylinder
Angle of cylinders	60 deg
B.H.P at sea level at 2000 r.p.m	400
Maximum r p m	2500
Economical r.p.m	1850
Ignition system, (type and make)	High tension—Splitdorf mag
Ignition system (single or dual)	Dual
Carburetor (type and size)	2¼ in 2 Zenith U S. 48 mm.
Number of main bearings	8
Type of oil pump	Gear
Capacity of oil pump through engine	26 lb /min. at 2000
Maximum oil temp. allowed	160 deg F in
Desired oil temp. under normal operation	140 deg F in
Oil pressure desired	100 lb /sq. in. ga.
Grade of oil desired	75 per cent Gulf 90-85 B 25 per cent Castor
Average oil consumption per hp. hr	.015 lb
Type of water pump	Centrifugal
Capacity of water pump through engine	510 lb./min at 2000
Maximum water temp. allowed	180 deg F
Capacity of cylinder water jackets	44 lb
Average fuel consumption per hp. hr	.52 lb.
Pressure of fuel supply	4 lb /sq. in. ga.
Speed of propeller	Crankshaft
Speed of tachometer shaft	½ crankshaft
Firing order	1L-5R 5L 2R-3L-4R-6L-1R-2L-5R-4L-3R
Approximate hours before overhaul	100
Life of motor	—
Weight of motor complete with prop. hub & water	716 lb
Weight of motor empty B without accessories	571 lb

An ambitious young lady

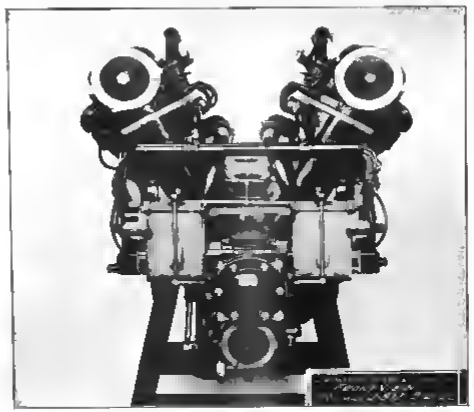
Aeromarine Model U873 Engine

A Development of the U8D in Which Numerous Refinements have been Incorporated

By E. A. Ryder, M.E.

Aeromarine Model U873, 8 cyl engine is 77 lb. lighter than U8D although of 18 per cent bigger displacement and is rated at 350 hp

The Navy Department, Bureau of Aeronautics recently inaugurated a more severe test for aircraft engines than has been used to date by making the length of the test 300 hr.



Front view of the Aeromarine U873

instead of 50 hr as was formerly customary The Aeromarine U8D engine was the first one to complete this test and a complete description of the 300 hr endurance run on the Aeromarine engine was published in AVIATION of Aug 7

In the light of the experience gained during the successful 300 hr test the Aeromarine Company has slightly modified the design of its eight cylinder engine which is now known as the Model U873 The displacement has been increased from 737 cu in to 873 cu in., and at the same time the weight has been brought down from 577 to 500 lb All this has been done without touching any of the essential highly stressed parts of the engine This weight reduction has been accomplished by refining detail parts and making new patterns for the larger castings. The crankshaft and main bearings are larger and heavier than they were in the former design

The principal changes from the old engine are:

1 The bore of the engine has been increased from 4¼ in to 4½ in. This was accomplished without increasing the length of the cylinder jacket. In fact, the new crankcase is 30 lb lighter than the old one

2. The connecting rod bearings have been made thicker to obtain double the stiffness of the old bearings

3. The crankshaft main bearing bushings have been increased in thickness and provided with flanges to obtain greater stiffness

4 The long webs of the crankshaft which were formerly chamfered off are now brought out to square corners.

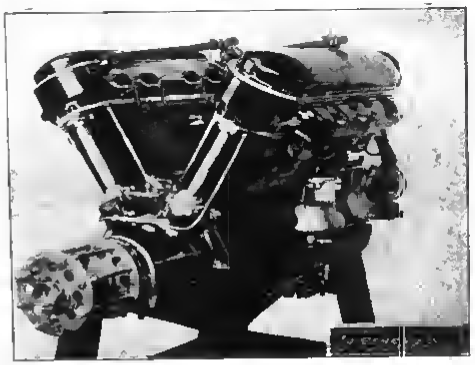
5 The driving connection between the crankshaft and the accessory assembly has been replaced by integral jaws on the crankshaft

6 The inlet valves have been slightly increased in diameter.

7. The pressure oil is introduced into the crankshaft through a special gland instead of through the center main journal.

General Description of Engine

The Aeromarine Type U873 engine is a 60 deg. "V," eight cylinder engine of 4½ in. bore and 6½ in. stroke. The Aeromarine Company has conducted extensive research on engine vibration in the past year both from a mathematical standpoint and in the experimental laboratory Harmonic balancing devices have been built and applied to various types of engines in order to counteract the sources causing vibration as far as possible, and permit the observation of the types of vibration that cannot conveniently be balanced, such as the torque reaction, and vibrations due to deformation of the engine parts or resonance incidental to the running of the engine It has been found that the 60 deg "V" engine is superior to other arrangements of eight cylinders, because in this type of engine the unbalance due to piston inertia manifests itself as a rotating force of constant magnitude The excursion of the engine due to this force is smaller, and the vibration of the airplane to which the engine gives rise is less objectionable than with types of engines having a linear reciprocating unbalance One of the fundamental objects in view in the design of the Aeromarine engine has been rigidity of the engine frame. The crankshaft, which is of large diameter is supported in three main bearings in an aluminum crankcase. This crankcase extends from a point considerably



Rear view of the Aeromarine U873

below the crankshaft center, to the top of the piston stroke and forms the water jackets as well as the crank chamber. The height of this casting is about 20 in and the length between the front and rear main bearings is about 24 in., so it will be evident that considered as a beam the crankcase is an enormously stiff member, and must maintain the crankshaft bearings in exact alignment under all operating conditions. The individual steel cylinder sleeves are inserted in the aluminum jacket so that the cooling water is in direct contact with the cylinders. The water joint at the bottom of the sleeve is sealed by a cork ring. This construction has been used by the Aeromarine Company for the last five years and has proved eminently satisfactory Accessibility is obtained by the use of detachable cylinder heads. Each head for four

cylinders is cast in one piece with the iron valve seats cast in place. A special method of dove-tailing is used for these seats, and no loosening up or leakage around them has ever been experienced. The gas pressure joint between the cylinder head and cylinder sleeve and the water joint between the cylinder and the water jacket or crankcase are made by a composite gasket arrangement which is the subject of a recent U. S. Patent. This gasket system has been used in aircraft engines with compressions running up to 7½ to 1, and insures against any leakage of either gas or water. The cylinder head can be removed and replaced several times without disturbing the gasket.

Camshaft Drive at Front End

The drive for the over-head camshafts is taken from the propeller end of the crankshaft. This has been the Aeromarine Company's practice for a number of years, and permits the use of light timing gears. It is found that when timing gears are located at the anti-propeller end of the engine the torsional deflection or "kick" of the crankshaft imposes severe stresses on the gear teeth and necessitates the use of a heavy pitch. An example of this is found in the Liberty engine which has required the timing gears materially strengthened in order to obtain a satisfactory life of these parts.

The cylinder heads can be removed and replaced without disturbing the timing gears. The tower shafts which connect the upper and lower timing gears have 10 splines at one end and 11 splines at the other. With the crankshaft set to the timing mark on the propeller hub, and the camshaft set in a corresponding position, it is only necessary to turn the tower shaft around and try successive splines until a position is found where it enters both the top and bottom gears. The timing can thus be effected to within one degree of camshaft movement. All the timing gears run in bearings of aluminum alloy and are supplied with pressure oil feed.

There are four valves per cylinder, two inlet and two exhaust, and in the U673 type of engine the inlets have been made slightly larger than the former ones so that even with the increased bore the mean gas velocity through the inlet valves is only 111 ft. per sec. at normal speed. The valves are operated by aluminum rocker arms and closed by flat leaf springs. The adjustment of the clearance between the valve and the rocker arm is effected by a hardened set screw which contains a half ball, bearing on the valve stem. The screw can be unlocked, adjusted, and locked again, quickly without disturbing other adjacent parts.

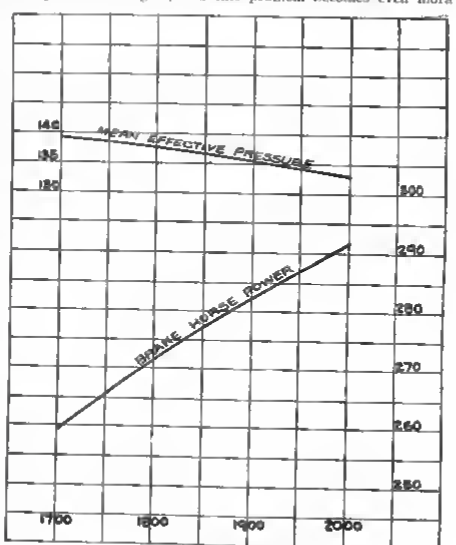
Exhaust Valve Cooling

Special attention has been paid to cooling of the exhaust valve. The exhaust valve stem is of large diameter and its guide is completely surrounded by water. Practically all of the cooling water for the cylinder heads is introduced directly under the spark plug boss and around the exhaust valve seat and stem, so that a constant circulation is assured over the surfaces that receive heat fastest. The exhaust valves are on the inside of the "V" and the inlet valves and carburetors outside of the crankcase. The valve which passed the Navy 300 hr. test had only five exhaust valves out of the thirty-two ground during the test. This was at the end of 200 hr. running and after the completion of the 300 hr. no difference in condition could be seen between these five valves and the others. It is thought that this exceptional performance was made possible by the extreme care taken in the design of the engine with regard to the cooling of the exhaust valve stem and guide. The valve mechanism is enclosed by a sheet aluminum cover and all the working parts such as cam rollers, rocker arms, and even the exhaust valve guides are positively oiled.

Pistons are of aluminum alloy and carry three compression rings and one scraper ring, with a groove under the scraper ring and a series of holes to permit oil to pass into the inside of the piston. The connecting rods are of tubular construction with a marine type brasses head. It is thought that failure of connecting rod bearings is often due to a lack of stiffness in these parts, so that under stresses imposed by the operation of the engine the bearings do not maintain their circular shape. It is well established that for perfect film lubrication it is essential to have the bearing and journal both truly round and the diameter of the bearing slightly greater than the diameter of the journal. This is the only condition that will permit the maintenance of a perfect oil film. If the bearing be ovalized by the forces acting on it the load will not be entirely supported by the oil but will come upon some part of the bearing metal itself. It is therefore essential to obtain the greatest possible stiffness in all the engine bearings. The crankshaft main bearing bushings are made thicker than usual and have wide flanges to stiffen them. The blade connecting rods which bear on the outside of the connecting rod bearing have steel caps with deep ribs so that stiffness is also assured in them.

Accessory Drive Standardized

One of the problems in present day aircraft engine design is the disposition of the large number of accessories required to operate the engine, and this problem becomes even more acute when several types of engines are contemplated. In order to eliminate the necessity for designing water pumps, oil pumps, starters, etc., for each individual type of engine brought out, the Aeromarine Company has developed a standardized accessory bracket which carries two magnetos, electric starter, hand crank with back-fire release, water pump, oil pumps and fuel pump. The water pump is made with one or more sections, depending on the size of the engine, and the oil pump is furnished with one, two or three sections to accommodate different schemes of oil storages, using either wet or dry sumps. If the electric starter is not required it may be replaced by a geared booster magneto to facilitate starting with a hand crank. The hand crank shaft can be brought out in a line parallel to the crankshaft or in any one of twelve positions at right angles to the crankshaft, so that the plane designer has a wide choice of location for the crank handle. Inasmuch as the Aeromarine Company is at present building a variety of engines ranging from 125 hp. to 700 hp. it will be appreciated that a standard accessory bracket which can be used on all these engines will be of material help, not only in manufacturing engines, but in giving service to machines in the field.



Guaranteed horsepower of Aeromarine U673 Engine with 6.35 to 1 compression, using 25 per cent benzol, 75 per cent gasoline

Ingenious Means for Cleaning Oil

The pressure oil pump has a much larger capacity than is customary and is intended to circulate enough oil to cool the bearings as well as to lubricate all the working parts of the engine. This pump draws its supply from the sump, if a wet sump is used, or from the tank in case a dry sump is used. A pressure relief valve is incorporated in the pump and this can be easily reached for making adjustment when the engine is mounted in the plane. The oil under pressure is fed into the anti-propeller end of the crankshaft through a metallic gland, (not on any main journal), and is taken out of the crankshaft through Aeromarine centrifugal separators so that only clean oil is supplied to the bearings. It is invariably found that after considerable running there will be a thick deposit of dirt in the mud chambers in the crankshaft, although there is no cutting or scoring of the bearings. The crankshaft plugs are easily removable, so that any accumulation of foreign material can be removed. Oil was formerly introduced into the center bearing of the crankshaft, but all the other bearings had the separator, it was noticed that the center bearing was the only one which showed any scratches. This condition has been eliminated by the use of a separate gland for introducing the oil. The camshaft and valve gear are supplied by external pipes at the propeller end of the engine, taking oil from the crankshaft bearing to the hollow camshaft.

One synchronizer drives of an approved type can be furnished and are driven from the anti-propeller end of the camshaft. Exhaust pipes are available in a variety of shapes so that the exhaust may be taken around either the front or the rear ends of the cylinder heads, or straight up over the center of the engine. The propeller hub takes a standard stock of 3.146 in bore, with eight bolts at 6.693 in. diameter. This hub can be furnished in two lengths, one of which brings the propeller as close as possible to the engine, and the other of which gives 2 in. of additional space between the propeller and engine so that a nose radiator with shutters may be used.

Provision is made for driving a generator, but this is not considered standard equipment.

CONDENSED SPECIFICATIONS

No. of cylinders 8.
Angle of "V", 60 deg.
Bore, 4¾ in.
Stroke 5½ in.
Displacement, 875 cu. in.
Brake hp. at 1800 r.p.m., 260
Fuel consumption lb./hp. hr., .43
Oil consumption lb./hp. hr., .02
Weight per brake hp., 1.92

The above figures are for the normal compression ratio of 5.85 to 1. (Model U875 Engine is also furnished with a compression ratio of 5.89 to 1.)

Dry weight including hand crank and propeller hub but not including gun synchronizer or fuel pump 600 lb.
Width between bearers 12 in.
Height above crankshaft, 25 in.
Total length, 45 in.
Total width 32¾ in.
Length over cylinder head 28 in.

Woman Flies Across Continent

Miss Lillian Gatlin, founder of the National Association of Aviation Gold Star Mothers, completed her trans-continental flight in Air Mail planes from San Francisco at 5.45 o'clock Oct. 8 when she landed at the United States Air Mail Service station, at Curtiss Field, Mineola, L. I. She made the trip in actual flying time of 27 hr. 11 min. She arrived in an Air Mail Service De Haviland machine.

Miss Gatlin left San Francisco Oct. 5, escorted by five Army planes and five civilian planes. Following the regular Air Mail Service route, stops were made at Reno, Nev., Salt Lake City, Utah, Rock Springs, Wyo.; Cheyenna, Wyo., North Platte, Neb., Omaha, Neb., Iowa City, Iowa; Chicago, Ill.; Cleveland, Ohio, and Bellefonte, Pa.

The flight was under the auspices of the Air Mail Service, to express the service's endorsement of a movement to set aside May 2, 1923, as a day for national remembrance of dead aviators. Miss Gatlin brought a letter from Mayor Thompson of Chicago to Mayor Hylan.

(c) Kadel & Herbert

Capt. F. L. Barnard on DH4A wins the King's Cup in the 'Round-Britain race, Sept. 8. Note the convenient scoreboard—a feature wanted on many a flying field.

Sampaio Correia Reaches San Juan

After many delays the Brazilian-bound H18 flying boat left San Domingo City at 11 a. m. on Oct. 8, and after a stormy crossing of Mona Passage, which is considered the most dangerous stretch of water in the entire Caribbean, arrived at San Juan, Porto Rico, four hours later. Considerable difficulty was experienced in getting the big ship off the water in a rolling sea and over one hundred waves had to be negotiated before it finally took the air. The trip was uneventful except for the continued overheating of the motors. It is contemplated to install a new set of radiators specially built for tropical service before the flight southward is resumed.

Book Reviews

ALL THE WORLD'S AIRCRAFT, 1922. Edited by C. G. Grey, Editor of *The Aeroplane*. 382 pp., ill'd. (Sampson Low, Marston & Co., London, England.)

This internationally known annual was founded by the late Fred T. Jane at a time when there was no aircraft industry anywhere in the world, and airplanes were privately built in backyards.

The thirteenth annual issue of this work constitutes a truly unique record not only of the world's airplanes, airships and aeronautical engines but also of the air forces and civil air services of the different countries. This year, for the first time, the information dealing with military and civil aeronautics has been printed in a separate section, as use of the book for reference showed the inconvenience of having this information combined with the products of the respective aircraft industry. As a result the book is much more readable and reference to any subject dealt with is made easier. It is in fact an indispensible reference work.

Achievements and Projects of the Air Mail

An Interesting Talk by Col. Paul Henderson Before the Aeronautic Executives' Luncheon

Night flying between Chicago and Cheyenne, with thoroughly equipped fields, flares and beacons will soon be undertaken by the Air Mail Service. This was the definite word given by Col. Paul Henderson, Second Assistant Postmaster General, in charge of the Air Mail Service, at the Aeronautical Executives' Luncheon held at the Automobile Club of New York on Sept. 12, where Colonel Henderson was the guest of honor.

Inglis M. Uppercu, president of the Aeromarine Plane & Motor Corp. and of the Aeronautical Chamber of Commerce, presided at the luncheon. In introducing Colonel Henderson Mr. Upperc u pointed out the great interest the aeronautical industry will take in the air mail's night flying experiment which, if successful, will lead to night flying on express and passenger routes with its saving in business time and increased traffic as a result.

Activities during Past Year

Colonel Henderson briefly reviewed the activities of the Air Mail Service during the past year. He gave the credit for the present success of the service to the energetic work done by two men, former second assistant postmaster general Otto Praeger and superintendent Carl Egge, who overcame obstacles of obstruction, skepticism, indifference and placed the service on a going basis.

The law, said Colonel Henderson, briefly provided for an airplane mail service between New York and San Francisco, a distance of 2680 miles. Twenty planes—ten each way—are daily in the air between the Atlantic and Pacific terminals, flying a total distance of 5360 miles each day. For the nine consecutive weeks ending Sept. 9, the service had shown 100 per cent performance, meaning that all flights were completed and on schedule time. Ninety-three per cent performance, with a total of 1,800,000 miles flown, was the record of the service for the fiscal year ending June 30 last.

Seventy planes are held in reserve on the ground, while from twenty-five to thirty are in the shops undergoing repair and overhaul. Much of the success of the service Colonel Henderson attributed to the policy of assigning to each pilot an individual machine which he flies continuously until repairs are necessary or it is "washed out."

Colonel Henderson paid a high tribute to the flying personnel all of whom with but four exceptions are ex-army and navy pilots. These fliers draw a base pay of $2,000 per year, with from 5 to 7 cents bonus for each mile flown (5 cents over the Prairie sections and 7 cents over the Rockies). On this basis the average yearly earnings of a mail pilot are about $4,500.

Organization of the Service

The organization of the air mail closely follows railroad practice, with superintendents in charge of the three main divisions under whom are the field superintendents. Sixteen men comprise a typical ground organization. At Chicago shops are maintained for rebuilding the DH planes turned over by the Army. The shops employ ninety men and have a capacity of eight ships per month. The mail service has about 500 Liberty motors in service and in reserve. Regardless of its apparent condition, no motor is allowed to remain in the air more than 100 hr. before being torn down and overhauled.

From a purely mail service point of view, declared Colonel Henderson, the airplane as constituted today offered very little unless it could be used day and night. After an investigation of some three months Colonel Henderson put the problem of night flying before his technical assistants. The resulting opinions as to the emergency landing fields required varied from one in 10 miles, one in 50 miles to none at all. He then employed a Cleveland engineer who knew nothing about flying and instructed him to take all the time necessary to find out (1) whether it is possible to fly at night, (2) how it can be done, and (3) to do it.

Within sixty days the engineer handed in a preliminary report on the feasibility of night flying and within ten days more had completed a study of the lighting requirements. Contracts for lighting the Chicago field in accordance with this engineer's recommendations have already been let. Both electric and acetylene lights will be used. It was discovered that when flat lights shine on a building its appearance was quite different from the same building in daylight. The solution was found in a system described as "daylight perspective." To accomplish that result the engineer in question has designed goose neck pipes so that light shines on the building the same as sunlight does. Lights somewhat stronger than automobile lights will be used to illuminate telltales and the planes themselves. The only lights on the field will be border lights and colored lights showing the aviator where to put his wheels down on the runway. A beacon light has also been developed with a visibility of 40 miles under average conditions, so that with beacons placed 80 miles apart one light will be theoretically visible at all times.

If the engineer's lighting system proves satisfactory at the Chicago field steps will be immediately taken to install similar systems between Chicago and Cheyenne, Wyo., where the flat nature of the country makes this the most practical stretch for night flying experiments.

The New York-San Francisco Night Mail

If the service is able to establish night flying between New York and San Francisco it will mean all the difference in the world in the value of the airplane in transporting the mails, in Colonel Henderson's opinion. The mail service made an experimental night flight from San Francisco to New York in February a year ago in 33 hr. elapsed time and 25 hr. flying time. Colonel Henderson believes that with the night flying equipment contemplated it will be practicable to make regular flights over the route in 28 hr. This will mean a tremendous acceleration of the mail service and would advance by three weeks mail from New York destined to the Orient.

Colonel Henderson gave detailed figures of the annual cost of transporting United States mails by various means of transport, pointing out that he was responsible for all transportation of mail except on star routes and rural routes. His figures show the total cost to be $159,058,000 of which only $1,000,000 (or about 1⅛ per cent) was spent on the Air Mail Service.

Alaska affords practical use for the airplane, Colonel Henderson said. He has sent two experts to Alaska, one on airplanes and the other on mail to investigate the situation. A typical Alaskan route is 250 miles long, with three stops, the mail an such a route averaging 500 lb. a month. An airplane could provide fast service on these routes at much less than the present cost. He considered it a safe prediction that mail would be carried by airplane on all the inland Alaskan routes in the not far distant future.

To operate a successful commercial air service Colonel Henderson believes night flying is essential, but that no private contractor could afford to make the night flying experiments which the air mail is undertaking. He hoped that within three years the Air Mail Service can be turned over to responsible contractors who will give the people efficient service at a profit to themselves. In Colonel Henderson's opinion people will then be willing to pay from 15 to 20 cents per letter extra for letters mailed in the afternoon at New York and delivered in Chicago the next morning. He believes that a new class of mail traffic will develop as the service develops. One illustration is transporting securities between important cities on which thousands of dollars interest is lost in transit. Bankers with whom Colonel Henderson has talked say that financial institutions are ready to support such a service as soon as they are assured of its reliability.

The Packard Model 2025 Engine

600 Hp. Engine which Will Furnish the Power for Several Pulitzer Race Entries

The Packard Model 2025 engine of 600 hp. will equip five Army entries in the Pulitzer race. The accompanying picture shows workmen in the engineering department of the Packard Motor Car Co. completing one of these motors, two of which will be mounted in planes produced by the Loening Aeronautical Engineering Corp., two in Thomas-Morse planes and the third in the Verville-Packard VCP-R plane.

The "2025" motor was designed and developed by Col. J. G. Vincent, vice president in charge of engineering for the Packard. It obtains its name from the fact that it has 2025 cu. in. of piston displacement.

The fire hazard is practically eliminated by the placing of the carburetor below and outside of the crank case, with all vents outside of the cowling. This arrangement also makes the carburetor more accessible and has the advantage of a gravity feed. The carburetor itself is of the duplex type.

Packard "2025," 600 hp. engine

Following are the chief characteristics of this engine:

CYLINDERS—Twelve cylinders, 5¾ in. bore by 6½ in. stroke-set at an included angle of 60 deg. Pistoa displacement 2025 cu. in.

CRANKSHAFT—The crankshaft is of the seven-bearing type, all bearing being carefully proportioned to give uniform life.

CONNECTING RODS—The connecting rods are of the straddle type, properly proportioned and equipped with proper bearings to give uniform long and uninterrupted service.

PISTONS—The pistons are of the aluminum die-cast type, equipped with floating piston pin.

COMPRESSION—Can be furnished either as high or low compression engine.

PROPELLER HUB—The propeller hub is of the quick detachable type, carefully designed to prevent freezing on the shaft or becoming loose.

CRANKCASE—The crankcase of box-section type, is split on the center line of the crankshaft with the main bearings carried between. Great rigidity is obtained by means of long through-bolts which serve the purpose of uniting the two halves into a rigid single unit.

CYLINDERS—The cylinders are of the individual steel type, now generally recognized as being the lightest and most reliable design developed to date. This type of cylinder gives the best possible water circulation and therefore the best valve cooling, with the result that valve trouble is practically unknown.

VALVES—Each cylinder is equipped with two inlet and two exhaust valves. The valves are 1⅞ in. diameter in the clear with 30-deg. seats—intake valve lift being 7/16 in. and the exhaust ¾ in.

CAMSHAFT AND ROCKER ARM—The camshaft and rocker arm assembly is of the enclosed type, developed by Packard long before this country entered the war, and was used on the Liberty engine with great success. This is one of the most successful types of valve operating mechanisms that has ever been designed for steel cylinder aircraft engines.

LUBRICATION—Lubrication is of the full pressure feed type, but contains many improvements dictated by long experience.

COOLING SYSTEM—The engine is designed especially for the use of a nose radiator but is equally adaptable to any other type of radiator arrangement. The water pump is equipped with an automatic spring take-up for the stuffing box and is readily accessible from underneath the engine.

CARBURETION—The carburetor is of the double Venturi type, with improved altitude adjustment. It is located on the bottom of the crankcase, which in addition to making it very accessible, provides for proper gravity feed—thus eliminating the complication of weight and pressure of pump feed.

IGNITION—The ignition is supplied by two twelve cylinder magnetos with fixed spark and vernier type coupling for synchronizing the magnetos. Complete double ignition to two sets of spark plugs is provided and engine will function properly on either set. The magnetos are easily accessible from each side of fuselage.

WEIGHT—The dry engine complete with propeller hub and battery weighs 1120 lb., or about 1.94 lb./hp.

Flying boat glider constructed by Herr Baats at Stralsund, Germany, resting on the sea after a successful trial flight

Army Flier Speeds 220 Miles an Hour

Lieut. R. L. Maughan Makes World Record at Garden City, Oct. 2

Lieut L R Maughan, who in the Curtiss Army Racer No 2, established a new world's speed record of 220 458 m.p.h. over an electrically timed course at Mineola, L. I., Oct. 2

Details of the test flight of one of the army's new airplanes, the Army-Curtiss racer No 2, held at Curtiss Field, Garden City, L I, Oct 2, revealed that Lieut R L Maughan piloted the airplane over a straightaway kilometer course at the rate of 220 458 miles an hour, faster than any human being had ever traveled

While a representative of AVIATION witnessed Lieut. Maughan's wonderful flight, the event was not recorded in the previous issue at the request of the Army officers in charge, who wished to withhold the story until the opening day of the Detroit Meet

The official report of the test was given out on Oct. 7 upon the arrival at Selfridge Field of Lieutenant Maughan and the record-breaking racer, which will be one of the twenty-three contenders for the Pulitzer trophy on Oct. 14.

The racer is a biplane powered by a Curtiss model D12 motor of 375 hp. It develops 430 hp at 2,250 r.p.m. and weighs but 1.58 lb per horsepower The weight of the engine is 715 lb A description of the engine appears elsewhere in this issue The wings measure only 19 ft. and the body is 18 ft. 11 in long A full description of the plane appeared in the Oct. 2 issue of AVIATION.

The electrically timed kilometer was placed in a ten-mile straightaway The first dash was made in 10.4 sec., or at the rate of 215.1 m.p.h., the second was made in 10 sec. flat, or at the rate of 223.704 m.p.h; the third in 10.2 or 219.318 m.p.h, and the fourth in 10 flat The average, computed to offset any wind advantage, gave the official record of 220.458 m.p.h The propeller slip is calculated at only 12 per cent.

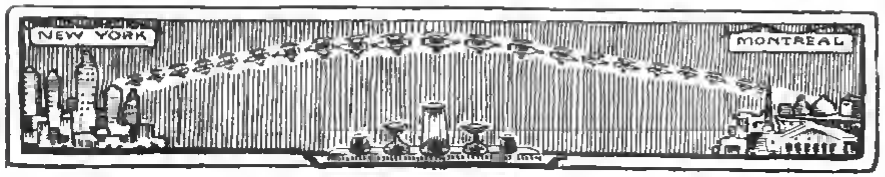
Unconscious in Turn at Plane

Coarse conditions were the same as those under which Sadi Lecointe established a record of 212.74 m.p.h in France several weeks ago

During the Garden City flight Lieutenant Maughan made a right angle turn, a feat which many experts believed impossible at such speed

Discussing the flight C Roy Keys, vice president and general manager of the Curtiss Aeroplane and Motor Corp., said that he asked the pilot what he was doing when he turned at right angles. Lieutenant Maughan was unable to explain it because it occurred while he was momentarily unconscious, stunned by the centrifugal pull.

Maughan's time was slightly better, it was said, than an army record established a week previously by Lieut. Lester J. Maitland over the same course Lieutenant Maitland's performance was not made public by the War Department, although he is unofficially credited with doing one of the 4 kilometer dashes at the rate of 223 m.p.h. Predictions are that even these speeds will be exceeded at Detroit.



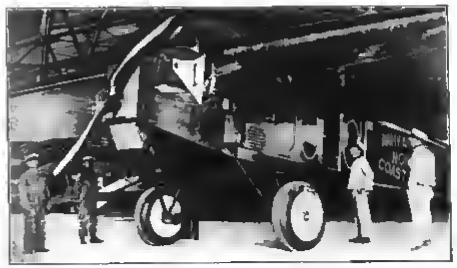
T2 Makes New Duration Record

Lieutenants MacReady and Kelly Stay Up 35 Hrs. 18 1-2 Min. in Army Transport Plane

On Oct. 5 and 6 Lieuts. John A. MacReady and Oakley O Kelly broke the world's duration record by staying in the air uninterruptedly for 35 hr 18 min. 30 sec The previous record, 26 hr 19 min. 35 sec., made by Eddie Stinson and Lloyd Bertaud at Mineola last winter was thus exceeded by the remarkable time of 9 hr. less 5 sec.

The flight started as a non-stop trip from Rockwell Field, San Diego, Calif., to the Atlantic seaboard, and was to terminate at either New York or Washington. Early in the flight the pilots found a foggy condition prevailing over the mountains which would have interfered with cross country work. Being all set for a long voyage, however, they decided to stay up and circle Rockwell Field in an attempt to break the duration record for sustained flight.

The ship used is known as the Army T2, and was originally built by Anthony O Fokker under the name of F4 as a commercial machine to hold 8 passengers and pilot Two machines of this type were ordered by the Army for experimental purposes and were delivered at Mc-Cook Field during last May. One of them, to be piloted by Lieutenant Kelly, has been entered by the Army Air Service in the Country Club of Detroit trophy race.



The Army Transport T2 (formerly Fokker F4) which made the record

The machine is a thick wing cantilever monoplane of 84 ft 6 in. spread. The wing is of wood construction, covered with three ply veneer, while the fuselage is built up of welded steel tubing. The pilot's seat is placed alongside the 400 hp Liberty motor, which is therefore located slightly off the center line of the ship.

The cabin was originally divided into two compartments but in order to equip the machine for a contemplated cross country flight to exceed 30 hr the following changes were made in the interior arrangement a tank holding 750 gal. or 4500 lb. of fuel was installed in the cabin Room for one man was left in the cabin, however, to provide space for the substitute pilot, and a door was cut in the forward wall of the cabin to permit the fliers to change places An extra control was installed in the cabin to permit manipulation of the ship while the pilot left his regular seat to go "below deck."

Detailed specifications of the F4 appeared in the Feb. 6, 1922, issue of AVIATION.

P & A Photo

Lieuts. J. A. MacReady and Oakley Kelly who set a new endurance record of 35 hr. 18 min. 30 sec. at Rockwell Field, Calif., Oct. 5 and 6

AEROMARINE -- PIONE IN THE DEVELOPMENT OF AERONAUTICS

There has been firmly established throughe country an active and intense allegiance to the Aeromarine name and the excellenc products of the Aeromarine factories - In establishing this allegiance the entire aeron al industry has benefited by the experimental work necessary to produce the finished engines and aircraft.

And in commercial operations the activities of the AERRINE AIRWAYS have added more prestige to the Aeromarine name and helped America forge ahead in aeransportation - To enumerate the many developments by Aeromarine during the past few years would take up tch space. Here are a few instances which clearly show why Aeromarine is widely known and famous :

Aeromarine 39B Seaplane

Developed during the war - Of new design and excellent performance.

Aeromarine Model 40-50 Flying Boats

Two distinct efficient machines noted for the case with which they handle and the reliability and economy with which they serve.

Aeromarine Encloaed Cabin Limouaine

First luxurious enclosed cabin flying boat designed for business or sport.

Aeromarine U-6- 130 H.P. Aero Engine

Praised by experts as a remarkably light, efficient engine.

Aeromarine Ke t-Havana Airway

The operation of thi oute converted thousands of America's wealthie s to the safety and charm of flying.

Aeromarine Palch-Havana-Nassau ay

Flying boats of the A blazed the first air trails between these cities - nce the first pioneer flight have carried thousand sengers without a single mishap.

Aeromarine New Atlantic City Airway

Now in its third year o sful operations.

Aeromarine Demonstrationa

Over all the waterway eastem half of the United States - In the campai l aviation to the public.

Aeromarine Sightseeing Flights - New York

Growing more popular each year - The thing to do when visiting N. Y. City.

Aeromarine U-873- 250 H.P. Aero-Engine

Conceded to be the world's greatest aero engine - The testing of which created a new and higher standard for testing aircraft engines.

Aeromarine Detroit-Cleveland Airway

First regular double daily Air Service between two large cities in the United States - Operations have just closed for the season with a record performance of 100%.

Aeromarine Safety Record

During three years operations flying boats of the Aeromarine Airways have carried thousands of passengers, more than one million passenger miles without a single mishap - surpassing all American and European records for over water air travel.

Aeromarine Engineeig and Sales Co.

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Lawrence B. Sperry, President, L. Sperry Aircraft Co., Farmingdale, L. I., N. Y.

Brig. Gen. William Mitchell, Assistant Chief of Air Service, U. S. Army

Inglis M. Uppercu, President, Aeromarine Plane & Motor Corp., Keyport, N. J.

Howard E. Coffin, Chairman Advance Committee on Organization, National Aero Association

Harold H. Hartney, Secretary pro tem., National Aeronautic Association

Jesse G. Vincent, Vice-President of Engineering, Packard Motor Car Co. Detroit, Mich.

Charles F. Redden, President, Aeromarine [illegible]

C. M. Keys, President, Curtiss Aeroplane & Motor Corp., Garden City, L. I., N. Y.

Sydney D. Waldon, President Detroit Aviation Society

Caleb S. Bragg, Chairman, Contest Committee, Aero Club of America

Charles F. Lawrance, President and Chief Engineer, Lawrance Aero Engine Corp., New York

Alfred V. Verville, Engineer, McCook Field, Dayton, Ohio

New Air Mail Radio Station

Addition of the sixteenth radio station for the Air Mail Service of the Post Office Department has just been authorized and equipment is already speeding on its way to Chicago, the location of the new link in the transcontinental wireless system.

This new station will be equipped with radio telephone in addition to radio telegraph in order that it may be available for experiments with night flying. The only other radio telephone station of the Air Mail Service is at the Post Office Department in Washington.

The Air Mail Station at Speedway Field has been using the Great Lakes Naval station radio for their regular radio business. However, the Naval Station is about forty miles from the Speedway Field and it was deemed advisable for the Post Office Department to have its own radio station on the grounds. The smoke stack of the huge Speedway hospital will be used as a support for the antennae of the new stations.

At the present time the new station will be used for regular business of the air mail and for experiments in connection with the proposed night flying service. It is understood that in the future it may be used for some broadcasting. The Washington station for some time has been broadcasting weather reports, and market reports.

Aviation Meet at Hartford

A Two Day Meet of Great Importance to Eastern Aviation Interests

The Second Annual Hartford Aviation Meet will be held on Nov. 10, 11 (Armistice Day) and 12, 1922, at the Hartford Municipal Airport, New England's finest airdrome, comprising over one hundred acres. The organizers aim to make this meet the largest ever held in New England and a demonstration to the public of the practicability of commercial aviation.

During the scheduled events, oil and gasoline will be supplied to all contesting planes free of charge as well as a

Trophy for accuracy in landing, one of the numerous valuable prizes

suitable supply at the time of departure. Living expenses, while in Hartford, of pilots and mechanics who are directly connected with planes which do not forfeit their entry fees will be paid by the meet for the period between 4.00 p. m., Thursday, Nov. 9, and 4.00 p. m., Sunday, Nov. 12.

It is hoped that all scheduled events will be completed on Nov. 10 and 11, and that Nov. 12 may be devoted to passenger carrying by commercial planes represented in the meet, for which a fee may be charged, and for an exhibition of planes.

Following are the general regulations governing the meet

General Regulations

1 The Flying Committee reserves the right to call off any event if there are not more than three entries for such event. In case an event is called off, those contestants who have entered will be notified on the closing of the entries.

2 The ratings given various aeronautical motors by the United States government will be accepted as final, so far as horsepower of any motors in planes contesting for any event where the horsepower of the motor is a factor involved.

3 In those events where contestants will fly from a distant point to Hartford, they will be furnished with their plane number. They will bring a certificate signed at the point of departure by two officials of a recognized Aero Club or two City officials.

4 The air line distance from the point of departure to Hartford will be considered as the number of miles flown in all events where the distance is a factor.

5 Applications for entry, accompanied by check for the proper fee, must be in the hands of the Flying Committee by noon, Oct. 25, with the exception of those events where this regulation is expressly waived.

6 All contestants of this meet will report immediately upon arrival to the Official in Charge of Flying, who will have charge of the flying during the meet, and whose decisions will be final. The Official in Charge of Flying will furnish all contestants with copies of rules and regulations governing the contests, which must be strictly adhered to.

7 No contestant or participant of any event will be permitted to indulge in "stunt" flying within the city limits of Hartford during the period of this meet, under penalty of being barred from participating in future events, forfeiture of entry fee and any prize or prizes to which he may be entitled, except with the express authorization of the Officer in Charge of Flying which shall specify the time and location. (The Hartford Municipal Airport is within the city limits.) All entrance fees and cups of each winner will be held until last day of the meet as forfeit to prevent winners, or contestants from "stunting." It is the idea of this meet to prove to the public the practicability of Commercial Aviation.

8 The Committee reserves the right to inspect all planes, and prohibit any plane from flying which, in its opinion, would be unsafe.

9 All contestants will notify the Hartford Aviation Commission by wire the probable date and time of arrival.

10 All entry fees will be returned upon last day of meet, provided contestants have complied with all rules and regulations and have participated in at least one of the events for which entered.

11 No protest will be considered unless made in writing and delivered to the Official in Charge of Flying within 24 hours after finish of the event over which protest is made.

List of Events

EVENT NO. 1—LARGEST DELEGATION

A prize to be given for the largest number of planes sent by any one Aero Club, individual or manufacturer.

Prize—Silver Loving Cup.

EVENT NO. 2—LARGEST DELEGATION

A prize to be given to the Government Station sending the largest number of planes.

Prize—Silver Loving Cup

EVENT NO. 3—MOST POPULAR PLANE

To be decided by vote of the spectators attending the meet.

Prize—Silver Loving Cup

EVENT NO. 4—MILES FLOWN TO HARTFORD

Contestants in this event must bring a certificate signed, as to time and date of departure, by two Aero Club or City officials at point of departure. Open to all classes of planes. Contestants in this event must arrive by 5:00 p. m. Thursday, Nov. 9. Miles flown to govern awards. Time will be a determining factor in awarding prizes to planes coming from equal distances.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

EVENT NO. 5—FREE FOR ALL SPEED RACE

Horsepower and rated speed unlimited. 45 Miles over a triangular course.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Loving Cup

EVENT NO. 6—SPEED RACE, CLASS A

45 miles over a triangular course. Open to all planes with a rated speed of 125 m.p.h. or less. In the event any contesting plane averages a speed of 125 miles or more per hour, such plane will be disqualified from receiving a prize.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

EVENT NO. 7—SPEED RACE, CLASS B

45 miles over a triangular course. Open to all planes with rated speed of 100 m.p.h. or less. In the event any contesting plane averages a speed of 100 miles or more per hour such plane will be disqualified from receiving a prize.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

EVENT NO. 8—ALTITUDE CONTEST (UNLIMITED)

No limit as to type of plane, equipment or time in the air.

Prize

1st—Silver Loving Cup

EVENT NO. 9—ALTITUDE CONTEST (LIMITED)

The plane reaching the highest altitude and returning to the ground within 15 min. will be declared the winner.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

EVENT NO. 10—ACCURACY IN LANDING

Engine to be cut over Airdrome at 1,500 ft. Each plane will be allowed three trials at landing within a given circle.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Loving Cup

EVENT NO. 11—FREE-FOR-ALL SEAPLANE SPEED RACE

Hartford to Springfield and return. Time of this race is counted from the time of the start signal to a designated point to which planes will taxi after landing in the water.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup

EVENT NO. 12—RELAY RACE

Four planes to a Team (Teams to be made up after arrival at the Airport). Each team will consist of two planes of Class A and two of Class B. The same observer must start and finish the race, changing from one plane to the other at the end of each lap.

Prizes

A silver loving cup will be awarded to each member of the winning team.

EVENT NO. 13—BOMB DROPPING

This event will be limited to such planes as are rated as bombers. (U. S. Government ratings accepted). Each plane will drop three dummy bombs from an altitude of 500 ft. at a given target.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

EVENT NO. 14—BURSTING TOY BALLOONS

Three balloons will be released for each contestant, the first being released from the ground when plane has reached an altitude of 500 ft. and the other two at intervals of one minute. Contestants bursting all balloons in the shortest time will be declared the winner.

Prizes

1st—Silver Loving Cup
2nd—Silver Loving Cup
3rd—Silver Medal

Navy Exceeds 200 Mile Speed

Speed exceeding 200 m.p.h. has been reached by the airplanes in which navy aviators have been training for participation in the Pulitzer Race at Detroit Oct. 14. Reporting such results to the Navy Department, the aviators who have been engaged in testing these speed planes state that the limit of speed at which a man can travel through the air and still maneuver and control his plane has apparently been reached.

Reports of performances submitted to Rear Admiral William A. Moffett show that speed of over 200 m.p.h. has been repeatedly recorded. Previous high records have been exceeded in many successive flights.

Ensign Alfred Williams of the Navy in recent tests with the Curtiss-Navy racer, made a turn of 180 deg. in 3½ sec. which means that while traveling at approximately 200 m.p.h. the direction of the airplane was completely reversed inside of that period. The effect of this maneuver on the pilot was to cause him to lose consciousness for an instant.

Pilots of these high speed machines have reported that in making such turns they have lost all control of the senses. The ability to see, feel or think has been temporarily lost, and instinct alone, they say, guides them in handling the controls.

The new Goodyear-built naval airship J1 with a close-up view of the car

Huff Daland Expansion

Huff Daland and Co of Ogdensburg, N Y, the manufacturer of the Petrel has more than doubled its factory facilities by the addition of over 15,000 sq ft of floor space in its factories. The most modern types of wood and metal working machinery have been installed to plant number two, and the factory as a whole has now a production capacity of four planes per month, with the ability to expand in time of need to many times that number.

This company is now devoting all its energies to the production of a series of planes built around the Gottingen 387 high lift thick wing. The Petrel was the first of these planes and was originally motored with the OX5, with which it gives a remarkable performance. The second development was the use of the Hispano Type A Motor, which increased the speed of the Petrel over 20 m p h and more than doubled its climb. With this motor the plane weighs only fifty odd pounds more than with the OX5, with an increase in power of over seventy per cent.

The second plane to be developed with the Gottingen 387 aerofoil is this company's new pursuit training plane built with the Lawrance 9 cylinder radial motor. Complete tests

Aerial booking office recently opened by Aeromarine Airways in the lobby of the Hollenden Hotel, at Cleveland, Ohio

on this ship have not been released by the Air Service, but unofficial reports credit the plane with a great rate of climb, high speed for a plane of its class, and an almost unbelievable degree of manuverability.

The third plane of the series is the new HN1, which is slightly larger than the Petrel, carrying 294 sq ft. of surface and powered with the E2 Wright motor. This is the plane which was flown by the Navy from Ogdensburg to Anacostia. It is characterized by the features of balance and inherent stability which mark the Petrel, and has been already designated by the Naval Bureau of Aeronautics as a "fool proof airplane." Describing a test of the plane's remarkable stability Comdr T G Ellyson said:

"In testing the plane for stability Lieutenant Neilsen released the controls, taking his hands and feet entirely off them. The throttle was cut to low speed and the plane went into a long glide. He then speeded up the engine, and without the controls being touched the plane levelled off and continued in normal flight with the engine (Normal r p m. above 2000) turning up from 1100 to 1200 r p m and the plane making about 60 knots per hour. Finally the engine was sped up and with the throttle wide open the plane began to climb, and in doing so her speed fell to about 40 knots. She fell off on one wing and dove until a speed of 100 knots was registered, when the plane again levelled off in normal flight.

"During the entire demonstration the pilot did not touch the controls with either feet or hands."

This performance calls to mind the extreme difficulty which pilots have encountered in an effort to make the Petrel tail-spin. The latter has the same peculiar capacity of falling from nearly any position into a dive from which it recovers itself to a slight glide without aid, and to a climbing position upon opening of the throttle.

Sale of Army Seaplanes

The Material Disposal & Salvage Section, Office, Chief of Air Service, Room 2624, Munitions Bldg, 20th and B Streets, N W, Washington, D C, announces that it will receive until 2 20 p m. (Eastern Time), Monday, Oct 20, 1922, sealed proposals for the purchase of the following government owned seaplanes and Liberty engines:

1 Five Navy F5L flying boats, complete, without engines, unassembled, hull good, wings in need of redoping and painting. Stored in hangar and not packed. At Langley Field, Hamptoo, Va.

2 Two HS2 flying boats, new, minus engines, serviceable. Stored in seaplane hangar at Langley Field, Va.

3 Twelve HS2L flying boats, new, minus engines, serviceable. Complete with instruments, propellers and packed in original cases as received from Curtiss company. Located at Middletown Air Intermediate Depot, Middletown, Pa.

4. Thirteen Liberty engines, low compression Navy type. Two are new, serviceable, complete, Packard built; eleven are new, serviceable, complete with exception of distributor heads. At Middletown Air Intermediate Depot.

5. Eight HS2L flying boats, new. Three of these are fitted with Liberty low compression type engine and accessories are packed in original cases received from Aeromarine Co. The remaining five are without motors and also packed in original cases. Located at Air Intermediate Depot, Richmond, Va.

6 One Curtiss F flying boat, minus engine, complete with wings, short one elock, one inclestor, needing new fabric. Crated. Manufactured by Curtiss company. Located at Rockwell Air Intermediate Depot, Coronado, Calif.

7. One lot of spares for HS2L flying boats, consisting of wings, elevators, balls, etc. All new and in good condition. At Air Intermediate Depot, Richmood, Va.

Performance of the B.M.W. 185 hp. Engine

N.A.C.A. Report No. 135

This report, by S W Sparrow, deals with the results of a test made upoo a B M W engine in the altitude chamber of the Bureau of Standards, where controlled conditions of temperature and pressure can be made to simulate those of the desired altitude.

A remarkably low value of fuel consumption—0 41 lb. per h hp hour—is obtained at 1200 r p m at an air density of 0 064 lb per cu. ft and a brake thermal efficiency of 33 per cent and an indicated efficiency of 37 per cent at the above speed and density. In spite of the fact that the carburetor adjustment does not permit the air-fuel ratio of maximum economy to be obtained at air densities lower than 0 064, the economy is superior to most engines tested thus far, even at a density (0.03) corresponding to an altitude of 23,000 ft.

The brake mean effective pressure even at full throttle is rather low. Since the weight of much of the engine is governed more by its piston displacement than by the power developed, a decreased mean effective pressure usually necessitates increased weight per horsepower. The altitude performance of this engine is, in general, excellent, and its low fuel consumption is the outstanding feature of merit.

New Safety Record of Aeromarine Co.

The Aeromarine double daily 90 minute flying boat service between Cleveland and Detroit was officially closed on Sept. 17, after a period of operations which commenced on July 17.

With two eleven-passenger Aeromarine cabin flying boats making two flights daily between the lake cities, a total number of 1829 passengers were carried, 222 crossings of Lake Erie were accomplished, 28 charter parties flown to points on Lake Erie, Lake St. Clair and Lake Huron, and 24 sightseeing flights made over Cleveland and Detroit. In addition to the 1839 passengers, 2574 lb of freight were carried, including a Ford model "T" roadster, several shipments of newspapers and miscellaneous bags, suitcases and golf bags.

There was a large increase in the second month's operations over the first. In the period commencing July 17 and ending Aug 17, 874 passengers and 549 lb of freight were carried. Forty-nine per cent of the travelers during this period were women. In the second month of operations, from Aug. 17 to the close, Sept. 17, 1065 passengers and 725 lb. of freight were carried. Thirty-two per cent of the travelers were women—the increase in percentage of male travelers in the second month being due to the fact that business men had realized the value of the service and were patronizing it more than they had during the initial month.

Throughout the season there were no forced landings or mishaps of any kind, and the boats left on schedule time.

An interesting comparison of the European performance as compared to this American record was made by C. F. Redden, president of the Aeromarine Airways, Inc.

"It is interesting to note that the European Air Transport Companies notwithstanding their government subsidies of 20 per cent or 30 per cent have failed to make any money," said Mr Redden. "Without government subsidy and without active government support we have operated at a profit. From the standpoint of the safety of passengers we have surpassed all foreign records. And in the matter of equipment, the luxurious enclosed cabin flying boats which we operate, surpass the European equipment in every particular."

There is still a heavy demand for transportation between Cleveland and Detroit and the Aeromarine Company will continue to keep three flying boats available for service until after the Pulitzer air races in Detroit, Oct 14. No attempt to maintain a regular daily schedule, however, will be made and the boats will only fly as the demand warrants.

The Aeromarine Company is the largest aerial transportation company in the world operating flying boats. The "black tail" flying boats of this company also operate between New York and Atlantic City, New York and Havana, Cuba, Miami, Bimini, Nassau, Key West-Havana, Palm Beach-Havana.

During the past three years of commercial operations the boats of the Aeromarine Airways have flown more than a million passenger miles and carried thousands of people without a single serious mishap—a record unexcelled or even equalled by any other aerial transportation company.

P. O. D. Thanks Aircraft Operators

Through the Aeronautical Chamber of Commerce, the Post Office Department sent a message of thanks to the civilian aircraft operators who for the last two months have held a thousand planes ready for emergency Air Mail Service in two hours' notice. The equipment placed at the disposal of the Government is based in California, Florida, Illinois, Indiana, Iowa, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Vermont and Washington. The offer to the Post Office Department was made by the Aeronautical Chamber of Commerce on July 13.

The letter from the Post Office Department to the Aeronautical Chamber of Commerce indicates the conviction on the part of Col. Paul Henderson, Second Assistant Postmaster General, that the railroad strike crisis is passed. "I feel that I should not call this a closed situation," he writes, "without endeavoring to express to you—and through you to the civilian aircraft owners, the appreciation not only of myself but the Postmaster General, of your offer of assistance in what at the time appeared to be a real emergency.

"I am sure that had the railroads failed us we would have been able to move a large volume of our mail by means of the airplanes mobilized through your office. Your offer of assistance is appreciated and the thorough work done by your organization makes me certain that your assistance would have been real."

Experimental Research on Air Propellers, V.

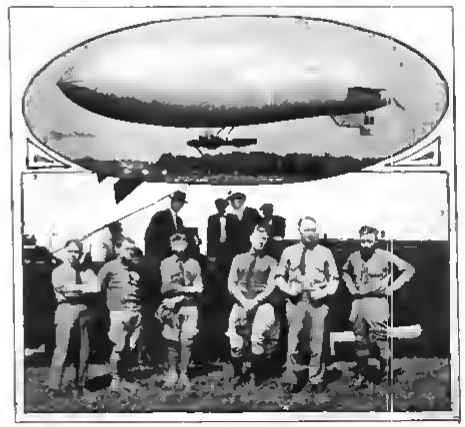
N.A.C.A. Report No. 141

In the previous reports on experimental research on air propellers, by W. F. Durand and E. P. Lesley, as contained in the National Advisory Committee for Aeronautics reports Nos. 14, 30, and 64, the investigations were made progressively and each without reference to results given in preceding reports and covering only information relating to forms perhaps adjacent in geometrical form and proportion.

The Report on "Experimental Research on Air Propellers, V" is a review of the entire series of results of the preceding reports with a view of examining through graphical and other appropriate means the nature of the history of the characteristics of operation as related to the systematic variation in characteristics of forms, etc, through the entire series of such characteristics. In reviewing the results a check was made of doubtful points by repetition of tests, to remove inconsistencies where found, and generally to develop for the series of models represented by these tests a consistent set of results as judged by the relation of those for any one model to those for all models adjacent in geometrical form and proportion. The report presents the results of this general analysis and review of the previous series of experimental observations. There is also added a series of nomographic diagrams for the rapid graphical solution of the problems such as are considered in the report. The diagrams have been prepared for both metric and English units.

A copy of this report may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Across the Continent



The Goodyear-built Army airship C2 and her crew, after arriving at Wingfoot Lake Air Station, Akron, during her transcontinental flight

Notice to Aviators

Athens, N Y.

High-voltage transmission cable—The Secretary of the Albany Southern Railroad Co reports that two 240-ft. steel towers have been erected carrying high voltage transmission wires across the Hudson River between Athens, N Y, on the western shore, and a point about 4800 ft southward of the railroad station at Hudson, N Y, on the eastern shore The wires are about 165 ft. above the water at the center of the river

Approx. position 42° 15′ N., 73° 48′ W

(N A. 7, 1922)

Frostburg, Md.

Landing field—The city of Frostburg, Md , has established and improved, at considerable labor and expense, a landing field about 2½ miles southeastward of that city The improved part of the field as it now stands is 1200 ft long by 1000 ft. wide, having sufficiently clear approaches to make it available for most of the present type planes

The field is marked by a circle, 100 ft in diameter, with a band 3 ft wide, painted white This marker indicates the center of the best landing area A wind cone has been erected to indicate the direction of the wind

The location of this field at Frostburg, in the center of a country where landing fields are few, is an important addition to the model airway, located as it is midway between Washington, D C, and Moundsville, W Va.

Approximate position, latitude 39° 40′ N, langitude 78° 55′ W

(N A 7, 1922)

Arlington Radio Station

Changes in weather report schedules—The weather bulletin for the benefit of marine and aviation interests issued each night by the U S. Weather Bureau and broadcast from the naval radio station at Arlington, Va. (NAA), will be broadcast at 10.30 p m , beginning with June 26, 1922 Heretofore this bulletin was broadcast at 10 p m., immediately after the time signal. Its contents also have been changed and extended to correspond with the marine and aviation bulletin as described in Weather Bureau circular of May 16, 1921, which is broadcast daily at 10 30 a m The a m bulletins are sent on a wave length of 5950 meters, are, and the p m bulletin on 2650 meters, spark, as at present.

Beginning with June 26, 1922, separate weather forecasts for each of the States east of the Mississippi River, except Indiana, Wisconsin, and Illinois, and a general forecast for the section comprised therein will be broadcast at 10 a m and 10 p m On Wednesdays, April to Oct 15, inclusive, a summary of weather conditions as they affected crops during the previous week will also be included

Warnings of storms, cold waves, frosts, and heavy snows issued in the afternoon will be broadcasted at 5 p m.

The amended weather broadcasting schedule of the Arlington Radio Station (NAA) is as follows

10 00 a. m.—State weather forecasts, 5950 meters, are

10.30 a. m.—Marine and aviation bulletin, 5950 meters, are.

5 00 p m —Special forecasts and warnings, 5950 meters, are

10 00 p m.—State weather forecasts, 2650 meters, spark.

10.30 p. m.—Marine and aviation bulletin, 2650 meters, spark.

(See Notice to Aviators 6 (61) of 1921.)

(N. A. 7, 1922.)

The marine and aviation bulletins will be immediately followed by hydrographic information

Warning

Experimental station, Duewest—The United States Weather Bureau is conducting free air investigations by means of kites and balloons at Duewest, S. C The kites are flown at all hours, both day and night, whenever wind and weather conditions are favorable A fine practically invisible steel wire is used and at times this reaches to a height of 2 to 3 miles and in exceptional cases even 3½ to 4 miles. It can readily be seen that should an airplane come in contact with this wire disaster would almost certainly result. It is therefore recommended that pilots do not fly within 5, and preferably 10, miles of Duewest.

Duewest is no longer an aerial mail station *nor is there any suitable landing field at or near this point*

Approx. position 34° 20′ N, 82° 24′ W

Similar investigations are also being conducted by the U. S Weather Bureau at the following places:

Name	Latitude.		Longitude.	
	°	′	°	′
Broken Arrow, Okla.	36	02	95	49
Drexel (near Elkhorn), Nebr.	36	02	95	16
Ellendale, N. Dak.	45	59	98	34
Groesbeck, Tex.	31	20	86	26
Royal Center, Ind	40	53	86	29

(See Notice to Aviators 4 (30, page 77) of 1922.)

(N. A 7, 1922)

* * *

Two 80-ft. steel radio towers are now in process of erection in the northeast corner of the landing field at Chanute Field, Rantoul, Ill Approach to the field at the point where the towers will stand is over some very high trees, and the towers will therefore offer very little hazard to airplanes about to land However, pilots not familiar with the topography of Chanute Field are cautioned to locate these towers before attempting a landing Each tower will be illuminated at night by an electric bulb mounted on the top of the mast

* * *

Two 80 ft. steel radio towers are under construction on the northeast corner of Kelly Field, along the Frio City Road southward of the post exchange gas filling station

When completed these towers will be painted black and white in alternate stripes to give them greater visibility The towers are 300 ft apart and will be connected by a six-wire antenna

The Challenge to the World

When, in July last, Rear Admiral Bradley A Fiske, U.S N. (ret) in his capacity of president of the "American Eagle" enterprise issued a challenge to the world to enter into a competition with the American group intending to build a 100 passenger seaplane for the circum-navigation of the world, it was rumored that a British firm was actually building a seaplane for this purpose Our Milan contemporary *La Gazzetta dell'Aviazione* now states that the machine in question, a four-engined biplane flying boat, will shortly be laid down at the Phoenix Works, and that it has the following characteristics

CHARACTERISTICS OF THE PHOENIX FLYING BOAT

Span, upper plane 285 ft. 8 in
Span, lower plane 184 ft. 8 in
Chord of main planes, 22 ft 7 in
Overall height, 51 ft
Length of boat 103 ft.
Span of tail plane 32 ft.
Length of wing floats 21 ft.
Engines 4 800 hp Rolls Royce 'Condor'
Propellers two 4 bladed tractors.
Total horsepower 4200
High speed (designed) 80 m.p.h.
Endurance 20 hr with 3½ tons of pay load

A seaplane of this type is believed to have been completed some time ago in England, but whether trials have as yet taken place is not known.

On the other hand the S. I. A. I. company of Milan, constructor of the well-known Savoia flying boats, is said to have also accepted the challenge of the American Eagle

The Italian challenger would have a minimum span of 100 ft with a total wing area of about 3000 sq. ft. and be equipped with sixteen 300 hp. engines, probably Fiat's. The cruising range of this flying boat is estimated at 6000 miles.

The same firm is incidentally building two three-engined flying boats of 90 ft span and a cruising radius of 3000 miles One of these craft is intended for a Danish polar expedition, while the other has been ordered by the Portuguese navy for a transatlantic flight which is to be undertaken by Captains Cabral and Coutinho, the heroes of the Lisbon-Rio de Janeiro flight

The Goodyear Semirigid Airship

In building its first semirigid airship, America will have the aid of Umberto Nobile, distinguished Italian engineer and co-inventor of the semirigid type of lighter-than-air ships. Engineer Nobile, to give him his official title, who is managing director of the Italian government aircraft factory near Rome, just arrived in this country on a three month's leave of absence, to assist in the calculation for building the 300-ft. semirigid airship for the U. S. Army, now under way at the Goodyear aeronautic factory

The modern semirigid type of ship originated in Italy and Engineer Nobile is the foremost authority on this type of ship in Italy, and consequently in the world In engaging him to come to America, the Goodyear Tire & Rubber Co , which has the contract for building the huge craft, wanted to take every possible precaution of safety and Engineer Nobile will personally calculate all the stresses that the ship will be subject to during flight or when moored out in the open. He has just completed the designs for a new semirigid ship for the Italian government, only slightly smaller than the one being built for the U S. Army, and expects to get back in his own factory by the time construction is under way, so that he can supervise that work.

The projected American ship, also called a "mother" airship, since it can be used as an airplane carrier, will have a capacity of 750,000 cu ft It will have a speed of 70 m.p.h. and a cruising radius of more than 4000 miles and will be able to pick up and release airplanes while flying at full speed. The distinguishing feature of this ship is its metal keel running the length of the 300 ft. gas bag The power cars containing engines and propellers and the navigator's car are to be suspended from this metal keel, while the huge gas bag will be attached to it at intervals of 10 ft.

This will be the largest semirigid ship in the world when it is completed, the only larger American airship being the rigid ship ZR1 now being built by the U S. Navy at Lakehurst, N J and at Akron

Death of Charles A. Singer

Charles A Singer, Jr , great grandson of Isaac M Singer, inventor and founder of the Singer Sewing Machine Co , died suddenly at the Misericordia Hospital on Aug 30 Mr. Singer, Jr , was vice president of Partridge, Singer & Baldwin, 44 Whitehall St., New York City

He was born June 5, 1885, in New York city and received his education at the Columbia Grammar School For years he was vice president and secretary of the Palmer & Singer Mfg Co At the outbreak of the war he was connected with the Ordnance Engineering Corp , but immediately resigned to accept a commission as Ensign with the Bureau of Ordnance of the Naval Aviation Division The first satisfactory bombing sights designed and used by the United States were made under Mr Singer's supervision

Upon receiving an honorable discharge from the Navy, Mr Singer became associated with the General Ordnance Co , leaving soon after to organize with his partners the present firm of Partridge, Singer & Baldwin He leaves a widow but no children

Addition to Boeing Plant

An article in the Seattle, Wash "Journal of Commerce" says the following of the Boeing Airplane extension and activities:

"A general contract for the erection of an addition to the assembling plant of the Boeing Airplane Co., 330 Front St, near the Duwamish Waterway, has been awarded to E O. Morgan Co, Railway Exchange Building The proposed addition will be of tile and mill construction, and the work will involve a considerable amount of tile and concrete work, also calls for the installation of electrical wiring and plumbing Work will be started as soon as material can be placed on the ground."

An Example of Curtiss Service

The Curtiss Aeroplane and Motor Corp., Garden City, L I., reports the following as another instance of the service they are giving to Curtiss owners The official making the report is C S Jones, Chief of Flying Operations:—

"During the recent period of bad weather an incident occurred which shows the extreme value of the aeroplane for quick service work.

"One of our machines had been in Pennsylvania on a big aerial picture contract and had been waiting over a week for the weather to clear sufficiently to do the work. Late one afternoon it showed signs of clearing, so the pilot got out the machine to be sure everything would be OK for the following day. Upon making a test flight it was found that the one magneto was entirely bad, due to extreme exposure to bad weather.

"It was found that by making the best possible train connections a mechanic could not reach the destination before 1 p m of the following day, which would be too late to repair the machine and do any work. Therefore a machine with mechanic and spare magneto left Garden City at day-break the following morning, making the 90 mile trip in 70 min., the magneto was changed and the ship in flying condition before 9 a. m. This enabled the pilot to make his flight and get his pictures. As it happened the weather turned bad again the following day, so that without this service the contract would have been delayed for another week, costing much money and additional expense and delay."

L. W. F. "Owl" Reconditioned

The L W F Engineering Co , College Point, L I , announces that the great biplane "Owl" which was originally designed for the Air Mail Service, has been reconditioned and accepted by the Air Service as a bomb carrier It is the only American machine in existence that can carry more than 2,000 lb of bombs It has a useful load of 4,000 lb and can carry a bomb of this weight for 550 miles.

The 'Owl" was tried out recently by Air Service Officers at Mitchel Field, L I, and General Patrick, Chief of Air Service, is quoted as having expressed great satisfaction at its performance. He was a passenger on one of its first flight while being formally examined

The specifications of the "Owl" are given in this issue under the information relative the Detroit News Aerial Mail Trophy Race, in which the big ship was entered by the Air Service.

Ten Weeks 100 per cent -- the Air Mail

Ten weeks of 100 per cent performance on all three divisions of the trans-continental air mail service will have to stand as the record for awhile. A radio from Iowa City reporting a definite on account of bad weather ended the longest period of perfect flying the air mail has made.

From the second week in July through the third week in September every air mail plane left its field according to schedule and the mail was carried the entire way to the destination by air Each plane carries from 400 to 500 lb of mail containing approximately 20,000 letters on each trip

For the last year 92 per cent performance was made by the air mail Fortified by the excellent record of this summer, it is hoped that this year's performance report will be even better

LAWRANCE MODEL J1 ENGINE

(Continued from p. 493)

adjusted for maximum horsepower When adjusted for minimum consumption, a figure as low as 0 46 lb. per hp. hour can be obtained The oil consumption is 0 03 lb. per hp hour

The same engine when fitted with E to I high compression pistons and using a fuel consisting of half benzol and half aviation gasoline develops nearly 240 hp at 1700 r-p.m. and 270 hp. at 2000 r-p m.

ARMY AND NAVY AIR NEWS

Air Service

Maj F M Kennedy to Zeppelin Factory—Maj Frank M Kennedy, formerly Executive Officer at Scott Field, Belleville, Ill has left for Friedrichshafen, Germany, where he will remain eighteen months, supervising the construction of a great Zeppelin airship being built for the United States by Germany.

"The object of the trip", said Major Kennedy, "and, in fact, the object of having Germany construct the airship for us, is to obtain the latest developments they have made in airship design and improvement" The Zeppelin will have a capacity of 2,470,000 cu ft of hydrogen gas, will be 671 ft. long and 80 ft in diameter It will carry six Maybach engines, have a 40-passenger cabin, be able to attain a speed of 85 m p h, and will be capable of flying 8500 miles without a stop It will be flown to the United States, one of the conditions being that a German crew bring the Zeppelin over, although several American officers probably will make the flight also. Ten months is the estimated building time, and thus, the ship should be ready for delivery in the fall of 1923 It is possible that it will be used by the navy for some time after it is acquired, but it is expected eventually to arrive at Scott Field"

• • •

Airplane Struck by Lightning—Having his plane struck by lightning, something that many pilots heretofore believed to be impossible, was the unusual experience recently of an Army Air Service pilot. A very large hole was torn in the wing, besides other minor demages, but the pilot escaped unhurt. He was a member of the class of students attending the advanced course in flying at Post Field, Fort Sill, Okla., who were on a cross-country practice flight and were homeward bound from Wichita, Kans

During this flight they encountered one of the worst storms that ever struck that region, the wind being so strong as to blow an entire train off the track. Some of the pilots were lucky to be far enough ahead to outride the storm, but most of them were forced right through it One pilot flew 4 hr 10 min before he landed at Post Field, although the trip normally takes 2½ hr Strong as the wind was on the ground, its strength was little compared to the force a few thousand feet up The gale seized the planes and rocked them from side to side as if they were wisps of straw Only constant and continued struggles on the part of the pilots kept their ships nosed into the wind Two pilots were forced to land, cracking up their ships as a result. Happily, none of the fliers suffered any injuries as the result of their harrowing experience

• • •

Flight Surgeons School Opens Fall Term—The Medical Research Laboratory and School for Flight Surgeons at Mitchel Field, L. I, N Y, opened its fall term recently with a class of twenty students in attendance, twelve of whom are Naval officers and eight Medical officers of the Army They will remain at Mitchel Field for a three months' course, upon completion of which they will be returned to their original stations for duty as Flight Surgeons, either in the Army, Navy or Marine Corps

• • •

Airplane Escort for the Vice President—During the recent visit of the Vice President to Eugene, Ore., a formation of three airplanes from the Army Air Service Detachment on duty at that place in connection with the fire petrol of the Oregon forests, escorted Mr Coolidge from Cottage Grove to Eugene, a distance of about 25 miles.

Army Orders—First Lieut. James B Jordan, to Ross Field, Calif., for duty.

First Lieut. Hugo P Rush, from Camp Custer, Mich., to Brooks Field, Tex, H T A training

Capts. William B Mayer, Lester T Miller, Raymond E O'Neill, John P Temple and Roger S McCullough; Lieuts. Karl S Axtater, Joseph P Bailey, Courtlead M Brown, Edward L Fernsten, William J Flood, James A Healy, Alfred L Puryear and Robert E Robillard—Scott Field, Ill., to course of instruction at Balloon and Airship School.

Maj Harvey B S Barwell, to member, Aeronautical Board, vice Maj Millard F Harmon, relieved

Maj Herbert A Dargue, to liaison officer of Air Service with Army War College, vice Maj Horace M Hickam, relieved

First Lieut. John F McBlain, Cav, transferred to Air Service, July 11, 1922.

First Lieut. Paul H Leech, Q.C, detailed to Air Service, to Brooks Field for training

First Lieut Roscoe C Wriston, from Kelly Field, Tex., to El Paso, Tex

First Lieut Adolphus R. McConnell, from Kelly Field, Tex., to Brooks Field, Tex.

Capt. Russell L. Meredith, from Wright Aeronautical Corp, Paterson, N J, to Selfridge Field, Mich.

Capt. Fraser Hale, from Bolling Field, D.C., to Georgia School of Technology, Atlanta, Ga., as ass't professor of military science and tactics.

First Lieut. David R Stinson, from Mitchel Field, L I, N Y., to Bolling Field, D C

First Lieut Lucas V Beau, from Mitchel Field, L I, N. Y., to Bolling Field, D C

Maj Wilhem C McChord, relieved from duty as Air Officer, 6th Corps Area, to Langley Field, Va., for training in Field Officers' School

First Lieut Frederick Von H Kumble, Inf, detailed to Air Service, to Brooks Field, Tex., for H T A training.

• • •

Aerial Observation School Makes Fine Record—The most thorough course in flying ever given to any Air Service class terminated at the School for Aerial Observers, Post Field, Fort Sill, Okla, on June 30, 1922

The course opened Jan 16, 1922, with three captains, eleven first lieutenants, one cadet from the Regular Army and one foreign officer, Lieutenant Shen from the Chinese Navy. The only changes in personnel during the course were as follows: On Feb 14, Cadet Wright crashed and was killed; on March 15 Lieut. Zuniga Cooper, of the Chilean Army, was transferred to the Observation School from the Communications School, and on April 12 Lieut. R L. Williamson was assigned to the school from Carlstrom Field. On June 30 the School graduated fifteen regular officers and two foreign officers

During the course the students averaged over 61 hr. of cross-country flying (one flying as much as 97½ hr), 7 hr formation and 86 hr routine (missions hison, etc.). The average time flown during this course per student was 154 hr but one pilot made nearly 190 hr This record far surpasses that for the previous year, when there were 32½ hr. of cross-country, 6½ hr formation and 52 hr routine, or a general average of 91 hr

Pilots, both students and officers assigned to the field, covered during this school year 470,880 man miles of cross-country flying and 390,105 man miles of airdrome flying This was more than for a like period the year previous and, in view of the fact that this class averaged only about one-third as many students as the former class, this is indeed a remarkable showing

Changes in Air Service Stations—The following changes in Air Service Stations are announced by the War Department

The following Air Service Plants will be sold: Chapman Field, Miami, Fla.; Love Field, Dallas, Tex., Americus Air Intermediate Depot of Georgia; Long Island Reserve Depot, N. Y. (Surplus sale, Nov. 14); Richmond Air Intermediate Depot (Surplus sale Oct. 30), The Curtiss Elmwood Plant, N Y (Property transferred to Agricultural Department, still to be removed)

The following Air Service stations will be retained for future use, but cleared of supplies and useless buildings and placed in charge of small caretaking detachments, thereby eliminating practically all overhead expenses: Park Field, Tenn, Carlstrors Field, Fla (Surplus sale Oct. 10); Dorr Field, Fla. (Surplus to be sold at Carlstrom Field), Souther Field, Ga., Ross Field, Calif (Installed-machinery, gas plant and equipment not subject to deterioration for Balloon companies in storage); Ellington Field, Tex. (Surplus sale at Houston Depot, Sept 22), Montgomery Air Depot, Ala. (Clean-up sale Oct 24).

The Middletown Ordnance Reserve Depot, Pa. (Evacuation Oct. 31, 1922) has been transferred to the Air Service

• • •

From San Antonio to New Orleans in 4½ hr.—Capt W P Hayes and Master Sergt. C W Kolinsky of the 90th Squadron, stationed at Kelly Field, San Antonio, Tex., recently made a test flight to New Orleans, La., with a remodeled DH4 airplane. They left Kelly Field at 6 15 a. m. and made the 560 miles to New Orleans in four hours and thirty minutes flying time, or at the rate of slightly over 124 m.p.h. One had only to do this trip by train at a temperature of 94 in the shade to become an enthusiastic exponent of aviation

Captain Hayes reports that, although the field at New Orleans was supposed to be in good condition, well sodded, he found the grass about eight feet high However, after negotiating a landing, it required four mules and eight men to get the ship out. The mules were furnished by the Park Department in preference to cutting the grass. Captain Hayes reports that every courtesy was shown by the city authorities and various civic organizations

• • •

Landing Fields in New England States—Lieut. C H. Howard, A S, recently returned from a fifteen hundred mile cross-country trip into Maine and Vermont, where he marked emergency landing fields and selected five large tracts of land which will be suitable for use in concentrating large divisions of the Air Force in case of emergency.

Lieut Samuel M Connell, AS, performed a similar mission through Northern New York, Connecticut and New Hampshire, traveling 1200 miles. He marked all emergency fields and located six large tracts of land near certain of the larger towns of New York State where encampments could most easily be located in time of emergency

• • •

Death Notice—The following death notice is announced by the Adjutant General's Office

RAYMOND E DAVIS

Born in Illinois, Aug 10, 1898 Appointed from Illinois, 1st Lieut A S July 1, 1920, accepted, Sept. 17, 1920

In Federal Service other than the permanent establishment: Pvt 1 cl Av Sec., Sig E R C., Aug 15, 1917, to Jan. 14, 1918; 1st Lt Av Sec. Sig O R C., Dec 24, 1917, accepted Jan 1, 1918, vacated Sept. 17, 1920.

Service—He was on duty at Post Field, Fort Sill, Okla. from Jan 15, to Mar 11, 1918; at Camp Dick, Tex to Apr 3, 1918; at Taliaferro Field, Tex to July 11, 1918, enroute to and on duty in France with American Expeditionary Forces, was a prisoner in German Camp from Sept 30 to Dec 3, 1918; returned to the United States July 29, 1919, on duty at Garden City, L I to Oct. 1919, at Langley Field, Va. to date of death He was killed in an accident at Mitchel Field, N. Y. Sept. 23, 1922

Cross-Country Flying in the Philippines—New instructions contained in a Philippine Department Bulletin have been issued to all Air Service organizations in the Islands, listing the equipment that will be required to be carried on all planes going on cross-country flights, and outlining the procedure incident to sending messages reporting arrivals and departures of planes. To the uninitiated in the flying conditions and hazards in the Philippines, it may seem that precautions taken are exaggerated, but after one has done some cross-country flying over country studded with rice paddies or over a vast expanse of territory presenting a perfect carpet of cocoanut palms to a pilot's eye, and after a few traps inland and seaplanes across water fairly prolific with such playful "denizens of the deep" as man-eating sharks, none of these precautions seem at all superfluous

• • •

Reserve Officers at Mitchel Field—Sixty-six reserve officers reported at Mitchel Field, Long Island, N. Y., on July 18 for two weeks' training A total of more than eight hours flying was given each of these officers In addition, the previously prepared schedule of ground instruction was carefully followed This program included airplane motors, trap shooting, firing of pistol course, machine gun instruction (ground and air) camera gun work, aerial photography, aerial navigation, and work on the miniature range On the whole, it is believed that the reserve officers attending this camp felt very well paid for the two weeks of their vocation which they spent at the field, and it must be said of them that due to their interest, close application and attention to duty, the progress of the camp was much more satisfactory than had been anticipated

Naval Aviation

Possible Advancement in Naval Aviation—An interesting idea of what may be accomplished by an enlisted man in the Naval Aviation Service is brought to light in an account of the experiences of Glenn Arthur Porter, ex-Aviation Carpenter's Mate, Second Class, U S Navy Porter was attached to Fighting Plane Squadron 2, of the Aircraft Squadrons, Battle Fleet, at San Diego, Calif., for sometime past. Having originally enlisted at New Orleans, La., Sept 15, 1919, as an apprentice seaman for Machinist's Mate, Aviation He was sent to the Naval Training Station, Great Lakes, Ill., for training, where he was soon rated, and where changed his rating to that of Carpenter's Mate, Third Class, (Aviation). After the regular period, he was then rated in Aviation Carpenter's Mate, Second Class

His easy adaptability to surrounding influences prompted him to learn to fly His interest in aviation increasing to such a point that he was unable to resist the opportunity offered by the sale of government planes and therefore out of his savings purchased one for his own use This airplane Porter completely overhauled, as well as the power plant, in his spare moments. On Sept 14, 1922, he was enabled to realize his secret ambition, that of having an Honorable Discharge from the U S Navy after service well rendered, and an airplane of his own in which he will fly to Longmont, Colo., his home. "The best interest and wishes of North Island are with Porter in the termination of his Naval service and his trip back home," says the Commander, Aircraft Squadrons Pacific Fleet, and adds "It is the hope of Fighting Plane Squadron 2 that in the near future Porter will again return and take up his former duties."

Coming Aeronautical Events

AMERICAN

Nov. 10-12 — Second Annual Hartford Aviation Meet, Hartford, Conn.

Oct. 22 — Aviation Meet to assist the family of late Lieut. Belvin W. Maynard, Curtiss Field, L. I.

FOREIGN

Oct. 16-21 — British Sailplane Competition. For Daily Mail Prize.

Torpedo Planes "Sink" the U.S.S. Arkansas—The Torpedo Plane maneuvers held off the Virginia Capes on Sept. 27 resulted in the theoretical destruction of the U.S.S. Arkansas, one of the three battleships attacked by the planes.

Seven hits were registered out of seventeen torpedoes discharged, all being on the Arkansas.

Eighteen planes under the command of Lt. Comdr. H. L. Bartlett, participated in the mimic battle, but one failed to discharge its missile. The test was staged under ideal weather conditions.

Promptly at 5 o'clock the flagship Wyoming, with Admiral J. C. McDonald, commander in chief of the battleship force of the Atlantic fleet, on board, and the super dreadnoughts Arkansas and North Dakota got under way and headed out to sea. After steaming three hours the fleet reached the rendezvous, about fifty miles off the capes, and awaited the attack.

At 9.20 the look-outs on the flagship sighted the naval dirigible C7, which was followed shortly afterward by a flotilla of scout planes and others carrying observers.

At 10.18 the first squadron of nine torpedo planes appeared on the horizon, and the battleships put on forced draft and began maneuvering at full speed to keep the attacking force astern. General quarters were sounded on all the ships, and they were cleared for action, while the guns were trained on the rapidly advancing "enemy." As the second squadron of torpedo-laden fliers drew near Admiral McDonald so placed his ships as to avoid the enemy force, keeping one squadron ahead and the other astern.

The dreadnoughts went into battle with the target ship Arkansas in the center of the line, the distance between the three warships preventing a broadside. Changing their tactics, the planes attacked on the flanks of the fleet and concentrated on the Arkansas, scoring their first hit on the starboard quarter. The angle fire was kept on the other two battleships, which were constantly maneuvering at full speed. The flag ship narrowly escaped and the North Dakota also escaped theoretical destruction by a slim margin.

The crews of the battleships, handicapped by the absence of supporting destroyers, were forced to defend themselves with their rudders, their guns being silent.

Three of the planes were forced down after the test, their gasoline tanks becoming empty after they had passed the capes on their return to the naval base here. The battleship Delaware was scheduled to take part in the maneuvers, but instead remained at anchor.

In the opinion of Rear Admiral W. A. Moffett, chief of the Naval Air Service; Commander T. G. Ellyson of Aviation, Navy Department, and Col. C. H. Danforth, Army Air Service, commandant of Langley Field, Va., the test was satisfactory in all respects, demonstrating, in their view, that planes equipped with torpedoes can successfully attack battleships from the surface, especially if protected by a smoke screen or fog.

The official report on the maneuvers is contained in the following message from Vice Admiral John D. McDonald, Commanding Battleship Force, Atlantic Fleet, to the Navy Department:

"Torpedo plane practice completed at 11.17 a. m. under most favorable conditions of weather and sea. Zero Hour 8.00 a. m. Dirigible observed at 9.35 keeping low over battleships during the practice. Scout planes observed 9.55 also keeping in vicinity of battleships. At 10.18 sighted torpedo plane squadron and maneuvered at high speed to keep planes astern. Plane squadron divided and attacked from both flanks, battleships maneuvering to keep planes ahead and astern. Arkansas sustained seven hits out seventeen torpedoes fire—all fired close aboard."

* * *

Naval Orders—Lt. Albert R. Mack, det. officer in charge Navy recruiting station, Des Moines, Iowa, to U.S.S. Aroostook as executive officer.

Lt. Arthur R. Nickerson, det. Nav. Prov. Ged., Indian Head, Md., to command Nav. Air Sta. Rockaway Beach, L. I., N. Y.

Ens. George F. Burdick, det. Nav. Air Sta. Pensacola, Fla., to R. Barracks, Hampton Roads, Va.

Ens. James D. Hazelden Jr., det. Nav. Air Sta. Pensacola, Fla., to R. Barracks, Hampton Roads, Va.

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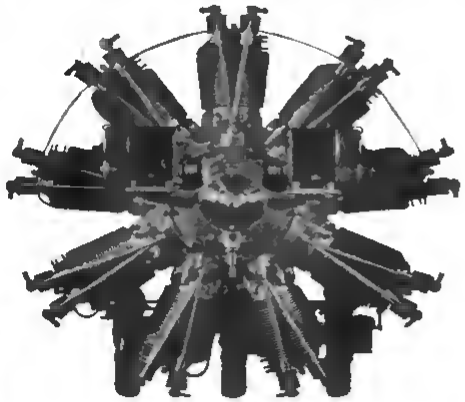

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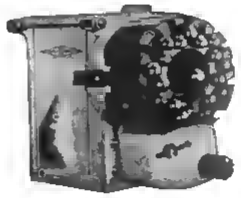

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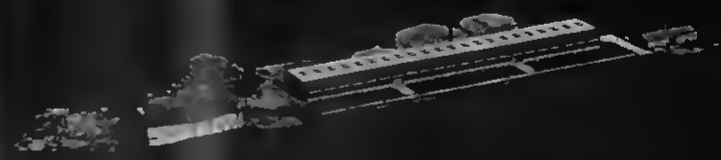

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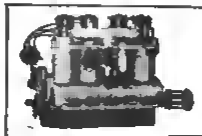

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THINK RIGHT QUICKLY

of some one thing you use in your business!

THEN think of this!—
"The War Department has it"

And the chances are better than 10 to 1 that the War Department has all the needful materials you can call to mind in an hour's steady thinking.

What does this mean to you?

It means, simply, that War Department sales give you an opportunity to buy, for considerably less, the very kinds of commodities for which you now are competing in the open market.

Two such opportunities are offered you in these auctions at Montgomery, Ala., October 24, and at Richmond, Va., October 30.

Remember the dates!

October 24, Montgomery, Ala.

October 30, Richmond, Va.

The Government reserves the right to reject any or all bids

A representative list of materials to be offered

AT MONTGOMERY

Arbors, bits, braces, calipers, chasers, chisels, chucks, clamps, collets, counterbores, cutters, files, gauges, hammers, tool holders, wrenches, soldering irons, levels, vise jaws, mandrels, planes, pliers, pulleys, punches, reamers, saws, stocks and dies, squares, stencils, taps, vises, emery wheels

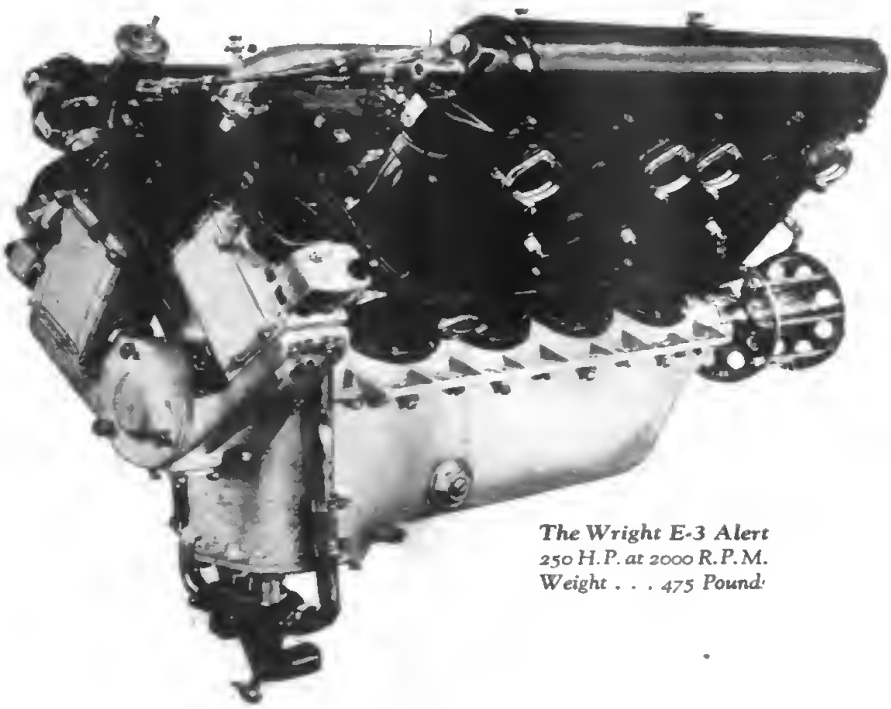
AT RICHMOND

Ratchet braces, vises, wrenches, gauges (various types), bevels, hacksaw blades, hacksaw frames, drills, hammers, soldering irons, micrometers, jacks, pliers, folding steel rules, saws, bolts, shovels, goggles, machinists' benches, sheet brass, drill rods, ball bearings (quantities), steel bars, lathe benches.

Catalogs showing all offerings in these two auctions, offerings well worth the time to investigate, are ready for you now. For the Montgomery catalog write Commanding Officer, Air Reserve Depot, Montgomery, Ala. For the Richmond catalog write Commanding Officer, Air Reserve Depot, Richmond, Va.

WAR DEPARTMENT

"FOREMOST IN THE AIR"



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250 H.P. at 2000 R.P.M.
Weight . . . 475 Pounds

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